Summer 1971

THE COMPOSITION, ABUNDANCE, AND SEASONAL PERIODICITY OF PHYTOPLANKTON AT LAKE WINNIPESAUKEE, NEW HAMPSHIRE

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by

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M.Ed., Springfield College, 1959

A THESIS

Submitted to the University of New Hampshire

In Partial Fulfillment of

The Requirements for the Degree of

Doctor of Philosophy

Graduate School

Department of Botany

July, 1971

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ACKNOWLEDGEMENTS

I express my sincere gratitude to the following people at the University of New Hampshire who have made this study possible: Dr. A. C. Mathieson for his direction and valuable assistance during the study; Dr. P. J. Sawyer; Dr. A. R. Hodgdon, Dr. C. G. Nast, and Dr. R. W. Schreiber for aid in the preparation and reviewing of the manuscript; Mr. G. L. Byers, Director of the New Hampshire Water Resource Research Center; Mr. B. J. Hutchinson for his aid in the preparation of the figures; Mr. D. C. Coleman for his energetic and enthusiastic assistance in the collection of field data. I am especially grateful to the faculty and staff of the Department of Botany of the University of New Hampshire for their encouragement and guidance and for the opportunity to use the facilities and equipment of the department.

The work upon which this thesis is based was supported in part by funds provided by the United States Department of Interior, Office of Water Resources Research, as authorized under the Water Resources Act of 1964, Public Law 88-379, through the Water Resources Research Center of the University of New Hampshire.

To my wife, Mary, for her persistent encouragement and for her patience in the typing of the manuscript. Lastly, to the "Seven" who served as a constant inspiration for the completion of this study.

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ABSTRACT

THE COMPOSITION, ABUNDANCE, AND SEASONAL

PERIODICITY OF PHYTOPLANKTON AT LAKE

WINNIPESAUKEE, NEW HAMPSHIRE

by

H. WILLIAM YEO

The composition, abundance, and seasonal periodicity of phytoplankton at Lake Winnipesaukee were determined. Trophic levels were evaluated for the entire lake and for eight individual stations. The study afforded an opportunity to compare the trophic levels of Lake Winnipesaukee with Newfound and Winnisquam Lakes.

Monthly collections were made at four stations (Alton, Wolfeboro, Weirs, and Center Harbor) from July 1969 to August 1970, while four other stations (Winter Harbor, Melvin Bay, Meredith Bay, and Paugus Bay) were studied during July through August 1970. Samples of phytoplankton were taken from three to six depths at each station with a 4-liter Van Dorn water sampler. Water samples were also taken for nutrient analyses of orthophosphate, total phosphates, nitrate-nitrogen and silicon dioxide. Living materials were used in the identification of taxa at each station. Phytoplankton cell numbers were determined using an inverted microscope and fixed materials.

The differences in phytoplankton numbers and nutrient levels were compared with previous records at Winnisquam and Newfound Lakes. The nutrient levels at Winnipesaukee were in excess of those previously recorded for Newfound and Winnisquam. It appears that the primary limiting factors for algal growth at Winnipesaukee are light and temperature.

The species composition at the different stations was dependent upon their trophic levels. The blue-green algae were the dominant phytoplankters at all stations, and they usually comprised the major portion of the cell counts. The concept of phytoplankton associations was useful in evaluating the trophic level of Lake Winnipesaukee. Although dominated by a Eutrophic Myxophycean Plankton, there were oligotrophic phytoplankton associations also evident.

The application of the phytoplankton quotient concept, to the individual stations provided a mesotrophic rating for the Weirs, Winter Harbor, Meredith, and Paugus Bay Stations while Alton, Wolfeboro, Melvin Bay and Center Harbor were categorized as eutrophic. A collective interpretation of the representative phytoplankton associations, also indicated mesotrophy as the trophic level of the overall lake. The most striking examples of eutrophy were found at the Wolfeboro and Melvin Bay Stations.

INTRODUCTION

During the past five years extensive studies have been made of phytoplankton populations associated with different levels of water quality in two bodies of water in New Hampshire (Newfound and Winnisquam Lakes). One paper dealing with a part of this work has been published (Gruendling and Mathieson, 1969) and another has been submitted for publication (Gruendling and Mathieson, in press). In both instances, an attempt was made to evaluate the interrelationships between the composition, periodicity and abundance of phytoplankton species in relation to nutrient levels at Newfound and Winnisquam Lakes. With the continued interest and support of the Water Resources Research Center of the University of New Hampshire, phase II of the above project was implemented at Lake Winnipesaukee.

Scenic splendor is unquestionably true of Lake Winnipesaukee. In fact, the Aquedoctan and Chocoruan Indians called the lake "Beautiful Water in a High Place" or Winnipesaukee (Blaisdell, 1936). The lake is surrounded by mountains. The Belknaps are to the Southwest, the Ossipee Range is to the North and the famed White Mountains lie to the Northwest (Goldthwait et al., 1951). "The Oldest Summer Resort in America" is located in Wolfeboro. Lake Winnipesaukee has long been a fisherman's paradise, a boater's haven, and a key subject for artists and photographers alike. The economic importance of Lake Winnipesaukee is immeasureable in terms of real estate development, recreational applications, and tourist revenue.

The objectives of this study were as follows: (1) to contribute to our understanding of New Hampshire Lakes; (2) to better interpret water quality characterization in terms of biological indicators; (3) to extend and improve the usage of phytoplankton quotients; (4) to allow a more functional understanding of the role of nutrients and phytoplankton growth; (5) to compare and contrast species composition, periodicity, and abundance of algal populations recorded at Newfound and Winnisquam Lakes with those at Lake Winnipesaukee.

METHODS

Monthly collections were made at Lake Winnipesaukee from July 14, 1969 to August 26, 1970, exclusive of the periods of ice formation and ice-out. Four stations were initially established at Alton Bay, Wolfeboro Bay, the Weirs, and Center Harbor, and they were retained throughout the project (Fig. 1). Four other stations (Winter Harbor, Melvin Bay, Meredith Bay, and Paugus Bay) were added for the months of July through August of 1970. The eight stations were selected on the premise that different trophic levels could be found in the same lake.

A 4-liter Van Dorn Water Sampler was used to take 6 samples (1, 3, 5, 10, 15, and 20 meters) at each station. Twenty-five ml subsamples were collected from each depth for phytoplankton enumeration; these were immediately preserved with three drops of acid Lugol's solution. One liter subsamples were also taken from the 5 meter depth at each station for nutrient analysis. The samples were then placed in polypropylene bottles and refrigerated for laboratory analysis. The techniques of Wood et al. (1967) were used to measure nitrate levels. Orthophosphate levels were determined using the methods of Murphy and Riley (1962). Total phosphorous levels were evaluated using the methods of Menzel and Corwin (1965). The handling of silicate analysis was as outlined in Strickland and Parsons (1960).

Light penetration was determined with a Whitney Underwater Light Meter (Model LMD-8A); the one percent transmission level was recorded. A Model TC-5 Thermistor, also from Whitney Underwater Instruments, was used to determine water temperatures and the relative extent of the epilimnion and hypolimnion layers.

Dissolved oxygen (in parts-per-million) was determined for each depth (1, 3, 5, 10, 15, and 20m) using a modification of the Winkler Technique devised by Hach Chemical Company. It incorporates the use of powder pillows which greatly expedites the process. Free CO_2 was determined by using phenolphthalein as an indicator and titrating with N/44 NaOH. Bicarbonates were determined using methyl orange as an indicator and titrating with N/50 H_2SO_4 to a salmon pink end point. The volume (ml) of titrating agent used (both N/44 NaOH and N/50 H_2SO_4) times 10 equaled the parts per million of free CO_2 or HCO_3 alkalinity. The latter two tests were made in Nessler Tubes with 100ml samples (Anon., 1961). A Beckman pH meter was used in the determination of pH values for each of the above depths.

A #25 Turtox Plankton Net was employed in making vertical hauls (20 meters in depth) at each station in order to concentrate living phytoplankton for identification. The samples were refrigerated and returned to the laboratory. The phytoplankton were enumerated according to the inverted microscope technique outlined by Lund, Kippling, and Le Cren (1958), using a Unitron inverted microscope (Model Bi-4777). A one ml unconcentrated sample was added to a sedimentation tube, allowed to settle for 15 hours, and then counts were made of the total number of cells per species under 200X magnification.

The identification of most organisms was made from living samples, except for the nannoplankton which were treated by sedimentation of fixed samples. The texts of Smith (1950) and Prescott (1951) were chiefly used for generic designations. Specific identifications were obtained from various sources as follows: Bourrelly (1957, 1968), Boyer (1916), Brandt and Apstein (1964), Cleve (1894), Cleve-Euler (1932), Croasdale (1935), Desikachary (1959), Drouet (1968), Drouet and Daily (1956), Forest (1954), Hustedt (1930), Irenie-Marie (1938), Palmer (1959) Ralfs (1848), Randhawa

(1959), Tilden (1910), Uherkovich (1966), Van Heurck (1896), West and Fritsch (1927), Whitford and Schumacher (1969), and Wolle (1887), 1892). A variety of other references listed in Gruendling and Mathieson (1969) were also employed.

DESCRIPTION OF LAKE AND ENVIRONMENTAL FACTORS

Lake Winnipesaukee is located at approximately 43°27' to 43°44' latitude and 71°30' to 71°10' longitude (Fig. 1). It has an area of 18,000 hectares or 180 km^2, a maximum depth of 51 meters, and it is the second largest lake in New England (Frey, 1963). The long axis of the lake lies in a northwest to southeast direction, which was that of the Pleistocene glacial scour (Goldthwait, et al., 1951). The glaciation impact easily eroded the weak Devonian bedrock of medium to coarse grained Kinsman Quartz Monzonite and Winnipesaukee Quartz Diorite (Billings, 1956). The lower Paugus and Alton Bay areas differ in that they are underlain by micaceous quartzite and coarse grained mica schist. Lake Winnipesaukee's ragged peripheral configuration is a result of this glacial excavation of weak bedrock areas and deep preglacial weathering (Goldthwait, et al., 1951) and it may be said to be a composite of the rock basin and drift dammed lake types (Hoover, 1938).

Determinations of the physical-chemical characteristics of Lake Winnipesaukee showed it to be a soft water lake with methyl orange alkalinity values ranging from 6.0 - 11.6 ppm and a pH range of 7. - 7.4 (Table I). No phenolphthalein alkalinity was detected and free CO_2 values ranged from 1 - 6 ppm (Table I). Oxygen values ranged from 4.6 - 16.2 ppm with rare recordings under 7 ppm, peculiar to a few 20m samples of late summer (Table I).

The maximum surface water temperatures (26.5 - 29.3°C) were recorded during July and August (Table I). In September, the surface temperatures diminished rapidly as did those for 3, 5, and 10m levels; by October 13, the upper 10m were isothermal. By October 27, the entire water column was isothermal at 13.6°C. During January to March 1970, the temperatures under the ice ranged from 1.9 - 2.6^{o}C, and a slight inverse stratification was evident. Ice cover ranged from 60 - 75cm, and ice-out occurred April 28. The spring overturn then occurred, the water temperatures increased rapidly, and thermal stratification was established by mid May. At the times of highest surface water temperatures, stratification was evident at all stations. The hypolimnion temperatures ranged from 7.5 - 17^{o}C.

The seasonal variation of light penetration (1% of the surface light) showed a definite correlation between the total phytoplankton crop and the depth of light penetration. As the total phytoplankton increased, the light penetration diminished and vice versa. The 1% light penetration ranged from 13 - 19m in June (at all stations) to a minimal range of 5 - 12m under the ice in February (Table I). The ice cover (60 - 75cm.), plus the ever varying amounts of snow above, greatly reduced light penetration during the winter months. The greatest number of phytoplankton for all stations occurred at the Weirs in August 1969 (Fig. 2), and it was accompanied by a drop in the 1% light penetration point from a July reading of 19m to 13m in August. With slight variations, light penetration generally decreased from June till ice-out, at which time it increased again. Increased particulate matter from run-off, lake turnover, pollen accumulation, and wind turbulence undoubtedly contributed to lower light penetration.

Nutrient level determinations for Winnipesaukee indicated similar seasonal trends at each station, with the variations being primarily in amount. Phosphate levels ranged from .04 - 1.0 mg/l at Stations 1 - 4 (Table II), with peaks occurring in July and August and minimal values in winter. The phosphate peaks of 39.2 mg/l at Meredith Bay and 1.38 at

Paugus Bay contributed to higher mean values (10 and .6 mg/l respectively) at Stations 7 and 8 than at Stations 1 - 4 (mean values of .1 - .3 mg/l).

Orthophosphate levels were also highest in July and August; they ranged from .08 - 3.73 mg/l at Stations 1 - 4 with mean values of .2 - .8 (Table II). Similar trends were apparent at Stations 5 - 8, except, for the higher summer mean (13 mg/l) at Meredith Bay (Table II). Minimal orthophosphate values were typical of the winter samples.

The silicate data indicated small peaks in July and August (up to 4.3 mg/l), with a brief decline in September. The silicate levels then rose progressively to maximal levels in February through June. The maximal silicate levels ranged from 3.6 mg/l at Center Harbor, to 8.4 at Alton Bay and the Weirs, and 15.6 at Wolfeboro Bay (Table II). Thereafter, these maximal levels usually persisted until May, and then gradually fell until June. Stations 5 - 8 exhibited a similar pattern of silicates in the summer months, except for one unusually high reading of 28.8 mg/l in July at Melvin Bay (Table II). The silicate mean values for all stations ranged from .8 - 2.8 mg/l, except for Melvin Bay which averaged 12.5 (Table II).

The highest nitrate levels for Winnipesaukee developed from July to August 1969, and January through March 1970. The average nitrate levels at Stations 1 - 4 closely approximated each other having a range of .5 - .6 mg/l, (Table II). The mean values of nitrates at Stations 5, 6, and 8 were similar with a range of .4 - .6 mg/l (Table II). Station 7 (Meredith Bay) had a mean value of only 0.1 mg/l (Table II).

GENERAL COMPOSITION OF THE PHYTOPLANKTON FLORA

A total of 453 taxa of phytoplankton were identified at Lake Winnipesaukee. A listing of the individual species and their seasonal occurrence at each station is summarized in Table III. The Chlorophyceae provided the greatest diversity of organisms with 237 taxa; 91 of the green algae were desmids and 115 were members of the Chlorococcales. The Bacillariophyceae comprised the second largest class of algae with 83 species; 73 of which belonged to the Pennales and 10 to the Centrales. Although the Cyanophyceae ranked third in numbers of species with 68, their cell counts far exceeded all other classes. The other major components of the phytoplankton flora were as follows: Chrysophyceae (34 species), Dinophyceae (17 species), Cryptophyceae (4 species), Euglenophyceae (4 species), and Xanthophyceae (6 species).

Tables IV and V indicate the combined monthly total in numbers of species per class at Stations 1 - 4 and 5 - 8 respectively. The Chlorophyceae were the dominant class throughout the study; the Cyanophyceae usually ranked second. The Bacillariophyceae and Chrysophyceae generally ranked third and fourth in numbers of species, while the Dinophyceae, Cryptophyceae, Euglenophyceae, and Xanthophyceae respectively, made relatively small contributions.

The monthly variation in numbers of species at all stations is shown in Figure 3. Stations 1 - 4 combined had a range of 208 species in July 1969 to 71 in February 1970; thereafter, the numbers of species progressively increased again to 200 in August, 1970. Stations 5 - 8 ranged from 159 in June 1970 to 222 in August 1970.

As suggested earlier, the Cyanophyceae usually dominated the phytoplankton in numbers of cells at all stations. Some of the blue-green algae that were present in greatest abundance were Polycystis aeruginosa, Polycystis incerta, Coelosphaerium naegelianum, Oscillatoria angustissima, Coelosphaerium pallidum, Gomphosphaeria lacustris, Aphanocapsa elachista, Gomphosphaeria lacustris var. compacta, and Aphanothece nidulans. Although other species made sizeable contributions, they were uncommon in comparison with the above blue-greens. Fewer blue-green species were involved in the Cyanophycean dominance in numbers of cells during the fall and winter seasons than during the spring and summer.

Chlorophycean species were usually the second largest contributors to the phytoplankton at each station, primarily because of their great species diversity. The green algae except for Gloeocystis vesiculosa and Botryococcus braunii were rarely dominant phytoplankters in terms of numbers of cells. The latter two species appeared in comparatively high numbers at all stations during the summer. Botryococcus braunii had peak numbers of $.39 \times 10^6$ cells/l in September 1969 at Alton while peak numbers of $.26 \times 10^6$ cells/l of Gloeocystis vesiculosa were recorded in August 1970 at the Weirs. The latter counts may be compared with those of two dominant blue-greens, Polycystis aeruginosa and Gomphosphaeria lacustris var. compacta, which had high cell counts of 4.07×10^6 cells/l in October 1969 at Wolfeboro and 2.18×10^6 cells/l in August at the Weirs respectively. Although the latter counts were unusually high, they exemplified the important contribution of the blue-green algae to the phytoplankton. Two other examples of green algae which were dominant phytoplankton components were as follows: Actinastrum hantzschii var. fluviatile with a count of $.4 \times 10^6$ cells/l in July 1970 at Wolfeboro and Ulothrix variabilis with $.41 \times 10^6$ cells/l in August 1970 at the Weirs. Dictyosphaerium pulchellum, Botryococcus protuberans var. minor, and Crucigenia truncata were occasionally abundant.

The Chrysophycean representatives such as *Chrysosphaerella longispina*, *Dinobryon divergens*, *Rhizochrysis limnetica*, and *Uroglenopsis americana* were abundant during July to September. The golden brown alga, *Dinobryon sertularia* var. *protuberans*, and diatoms such as *Melosira ambigua*, *Tabellaria fenestrata*, *Asterionella formosa*, *Fragillaria crotonensis*, and *Cyclotella comta* then became major phytoplankton components throughout the winter. The peak numbers of diatoms occurred during December-January and May-June.

The Chrysophycean flora was most abundant at Center Harbor and Paugus Bay. *Uroglenopsis americana* and *Dinobryon divergens* contributed .45 and .085 x 10^6 cells/l respectively at Center Harbor during July 1969. *Rhizochrysis limnetica* contributed .133 x 10^6 cells/l in August at Center Harbor and combined with the latter two algae to make the Chrysophyceae the second largest contributor of cells. The cell count of *Uroglenopsis americana* rose to .71 x 10^6 cells/l in October; a comparable count occurred in November. *Uroglenopsis americana*, *Dinobryon divergens* and *Rhizochrysis limnetica* were primarily responsible for the Chrysophycean peaks recorded at Center Harbor from July through November 1969. The Chrysophycean peak at Paugus Bay was dominated by *Dinobryon bavaricum* and *Uroglenopsis americana*. An unprecedented pulse of 2.01 x 10^6 cells/l of *Chrysosphaerella longispina* occurred in August 1970.

PHYTOPLANKTON POPULATIONS AT INDIVIDUAL STATIONS

Alton Bay

A total of 259 taxa of algae were identified from Alton Bay (Table VI). The members of the Chlorophyceae were the dominant class, being represented by 118 taxa (Table VI). The Cyanophyceae and the Bacillariophyceae followed with 49 and 44 species respectively (Table VI). Table VII indicates the total number of species per month at each station. Alton Bay had a maximum of 116 species in July 1969, a general decline to 35 in March and then a progressive rise thereafter. Figure 4 shows the seasonal variation in numbers of species per class. The Chlorophyceae had a maximum of 48 species in September 1969 and a minimum of 8 in March 1970 (while under ice cover). The blue-greens exhibited a high of 27 taxa in July 1969 and a low of 11 in May 1970. The Bacillariophyceae were most numerous in January 1970 with 27 species; only 10 were found in March.

Figure 5 shows the monthly variation in numbers of cells per class, expressed as the mean count for all depths sampled. The Cyanophyceae dominated with a maximum of 5.9×10^6 cells/l in September 1969 and a minimum of $.35 \times 10^6$ in February 1970. The Chlorophyceae ranged from a high of $.65 \times 10^6$ cells/l in September to a low of $.027 \times 10^6$ in March 1970. A pulse of $.467 \times 10^6$ cells/l in January 1970 was the high for the Bacillariophyceae; their minimum was $.068 \times 10^6$ in March 1970. The Chrysophyceae occasionally contributed substantially to the total phytoplankton; a maximum of $.794 \times 10^6$ cells/l being recorded in August 1969. A minimum of $.006 \times 10^6$ cells/l was recorded in March 1970.

The Cryptophyceae was the fifth largest class, having a range of $.047 \times 10^6$ cells/l in August 1969 to $.002 \times 10^6$ in February 1970. The Dinophyceae, Euglenophyceae, and Xanthophyceae contributed little to the numbers of cells.

Table VIII gives the monthly percent composition of total cells per class at Stations 1 - 8 and the average **yearly** percent composition of each class. The average yearly percent of Bacillariophyceae was 13%, while the more diverse Chlorophyceae comprised 6.3% and the Chrysophyceae 7.2% of the total phytoplankton. The Cyanophyceae comprised approximately

73% of the yearly phytoplankton composition. The four remaining classes combined only represented .5% of the cell count at Alton Bay.

The seasonal variation in numbers of cells for Stations 1 - 4 is indicated in Figure 6. A maximum of 7.37×10^6 cells/l was noted for August 1969, with a minimum of $.667 \times 10^6$ in March 1970 (under ice cover).

Wolfeboro

The greatest species diversity was found at Wolfeboro (Table VI). A total of 283 taxa were identified, comprised of 138 Chlorophyceae, 55 Bacillariophyceae, 46 Cyanophyceae, 27 Chrysophyceae, 7 Dinophyceae, 4 Cryptophyceae and Euglenophyceae, and 2 Xanthophyceae. A maximum of 127 taxa was identified in August 1969, as contrasted to 46 in February 1970 (Table VII). Slight fluctuations occurred from July through October. There was a general decrease in the number of taxa with the advent of winter; thereafter, there was a steady rise after ice-out. The Chlorophyceae ranged from 51 taxa in July 1969 to 14 in February; their numbers then rose again to 61 in August 1970 (Fig. 7). The Cyanophycean species ranged from 33 in July and August of 1969 to 5 in February 1970; subsequently they rose again to 25 in August 1970 (Fig. 7). The Bacillariophyceae and Chrysophyceae rounded out the four largest contributors in species showing a comparable seasonal cycle like that found at Alton Bay.

Once again the Cyanophycean cell count usually exceeded all other classes. A maximum of 8.99×10^6 cells/l was found in September 1969 with a low of $.047 \times 10^6$ in February 1970 (Fig. 8). In contrast the Chlorophycean total cell count ranged from $.893 \times 10^6$ cells/l in July 1969 to $.055 \times 10^6$ in May 1970 (Fig. 8). A pulse of $.829 \times 10^6$ cells/l in January 1970 was the maximal for the Bacillariophyceae; a low of $.087 \times 10^6$ occurred in August 1970 (Fig. 8). A pulse of $.536 \times 10^6$ cells/l of Chrysophyceae was evident in August 1969 and another of $.681 \times 10^6$ in August 1970 (Fig. 8). At the times of these August pulses, the Chrysophyceae ranked third in their contribution to the total cell numbers, behind the Cyanophyceae and Chlorophyceae respectively. The remaining algal classes, by comparison, contributed minimally both to species diversity and to cell numbers. The percent of total cells per class was basically similar to that of Alton Bay (Table VIII). The largest phytoplankton count for Wolfeboro was 9.97×10^6 cells/l in September 1969; a minimum of $.486 \times 10^6$ was recorded in February 1970 (Fig. 6).

Weirs

The species diversity at the Weirs Station was basically similar to Stations 1 and 2, except for the reduced number of diatoms (Table VI). Two hundred and forty-six taxa were identified. The Chlorophyceae dominated the phytoplankton in total species each month (Fig. 9). The 131 algal taxa identified during August 1969 was the highest monthly record for any station (Table VII). The maximum number of species evident during ice cover was also found at the Weirs (Table VII). Although the proportion of species per class approximates that of other stations, there are some noticeable variances in total cell numbers (Fig. 6). For example, one may note the largest total cell numbers recorded for the project (i.e. 13.6×10^6 cells/l in August 1969). Once again the Cyanophyceae contributed the major portion of the total cell count with 12.29×10^6 cells/l, the highest individual class count for the entire project (Fig. 2). The Bacillariophyceae, as at other stations, exhibited a January pulse of $.855 \times 10^6$ cells/l (Fig. 2). The latter was the highest diatom count at any station. The diatoms at this station averaged 12% of the yearly total phytoplankton (Table VIII). The average yearly contribution of blue-greens was 74%, while the greens contributed 6%, and the golden-browns 7.5%.

Though the January diatom pulse was the highest recorded at any station, it only represented 17.2% of the cells of phytoplankton that month. In contrast, a smaller population of diatoms recorded during June 1970 at the Weirs contributed 44.6% of the monthly cell numbers (compare Fig. 2 and Table VIII).

The Chrysophycean impact on the total cell count, as at the other stations, was usually greatest in May and June when it comprised 12 - 36% of the phytoplankton at the Weirs (Table VIII). A Chrysophycean count of .256 x 10^6 cells/l in June of 1970 accounted for 24% of the total phytoplankton.

Center Harbor

Of the 233 taxa found at Center Harbor, 103 were Chlorophyceae, the fewest such species recorded for Stations 1 - 4 (Table VI). A maximum of 104 species was found in November 1969 and a minimum of 59 in March 1970 (Table VII). The usual Chlorophycean dominance of species (Fig. 10) was correlated as in the case of the Cyanophyceae with total cell numbers (Fig. 11).

The highest cell count of Bacillariophyceae was recorded during May 1970 (.399 x 10^6 cell/l) and it resulted in 30% of the total phytoplankton (compare Fig. 11 and Table VIII). Thus, the Bacillariophyceae were usually the second largest component in numbers of cells (Fig. 11). The average yearly contribution of Chrysophycean algae was 14% as contrasted with 12% for the Wolfeboro Station, 7.5% for the Weirs, and 7.2% for

Alton Bay (Table VIII). The May 1970 Chrysophycean count of .434 x 10^6 cells/l equalled 32% of the phytoplankton (compare Fig. 11 and Table VIII). Although the golden-browns exerted a strong influence (percentage-wise) from May through August at Wolfeboro, the total numbers never exceeded those at Center Harbor (compare Table VIII and Fig. 11). The seasonal variation in numbers of cells at Center Harbor ranged from a high of 6.13 x 10^6 cells/l in October 1969 to a low of .697 x 10^6 in March 1970 (Fig. 6). Thus, Center Harbor was the least productive of the four major stations in terms of total phytoplankton. It also exhibited the lowest species diversity, with a minimal number of green algae (Table VI).

Winter Harbor

Stations 5 - 8 cannot be favorably compared with Stations 1 - 4 because their study encompassed only the summer of 1970. Even so, the same general distribution of species per class existed at Winter Harbor (Station 5) for the 180 taxa (Table VI). The blue-green species exceeded the more diverse greens in terms of numbers of cells with 3.59 x 10^6 cells/l in July (Fig. 12) or 82.1% of the total cell count (Table VIII). The Bacillariophyceae composed the second greatest portion of the phytoplankton making up 35% in June and 10.2% in July (Table VIII). A pulse of .659 x 10^6 cells/l of Chrysophyceae in August (Fig. 12) produced the second largest portion or 16% (Table VIII) of the total. Blue-green cells equalled 64.6% of the phytoplankton during the summer, greens 6.4%, diatoms 16.6% and golden-browns 12% (Table VIII). The July count was the greatest recorded with 4.33 x 10^6 cells/l (Fig. 13).

Melvin Bay

Melvin Bay (Station 6) had the fewest species for Stations 5 - 8 with

174 taxa (Table VII). The blue-greens contributed 54.6% of the total phytoplankton cell numbers, and the Chrysophyceae, Chlorophyceae, and Bacillariophyceae 17.7, 15.3, and 11.6% respectively (Table VIII). A Chrysophycean pulse of .326 x 10^6 cells/l (Fig. 12) accounted for 36% (Table VIII) of the June phytoplankton. The diatoms with .245 x 10^6 cells/l (Fig. 12) made up 27.2%, the greens 23%, and the blue-greens 12.1% of the June phytoplankton (Table VIII). As at other stations, the blue-greens were the primary phytoplankton component during August, composing 78.1% of the total cell count (Table VIII). The largest number of Chlorophycean species recorded during the study was found in August at Melvin Bay. However, the 62 species of greens (Fig. 14) comprised only 9% of the total phytoplankton (6.87 x 10^6 cells/l). Compare Table VIII and Figure 13 for this interpretation.

Meredith Bay

One hundred and seventy-five taxa of phytoplankton were found at Meredith Bay (Table VI). The Bacillariophyceae with .490 x 10^6 cells/l (Fig. 12) made up 47% and the Chrysophyceae 29% of the June phytoplankton (Table VIII). The blue-greens dominated in numbers of cells during July (Fig. 12). In August, they equalled 82.5% (Table VIII) of the phytoplankton with a count of 4.99 x 10^6 cells/l (Fig. 12). An August pulse of .659 x 10^6 cells/l of Chrysophyceae (Fig. 12) resulted in 10% (Table VIII) of the phytoplankton; the remainder was primarily composed of Cyanophycean cells. The maximum phytoplankton count recorded was 6.08 x 10^6 in August 1970 (Fig. 13).

Paugus Bay

Paugus Bay had the largest number of taxa (186) of stations 5 - 8 (Table VI). In addition, it had the greatest phytoplankton counts of the latter stations with 6.94×10^6 cells/l in July (Fig. 13). The Cyanophyceae composed 58% of the total phytoplankton during the summer (Table VIII). A strong pulse of Chrysophyceae (i.e. 2.12×10^6 cells/l) accounted for 30.1% of the August phytoplankton (Fig. 11).

CALCULATION OF PHYTOPLANKTON INDICES

The trophic level of Winnipesaukee was evaluated using a variety of phytoplankton indices such as the Chlorophycean Quotient of Thunmark (1945), and the Myxophycean, Diatom, Euglenine, and Compound Quotients of Nygaard (1949). A summary of the indices' values and the suggested trophic levels for Lake Winnipesaukee and for each station is found in Table IX and X. Since summer is the more optimal growth time for green and blue-green algae, Nygaard felt that all of the indices were best applied during June through August, with the exception of the Diatom Index.

A summary of the quotients and their interpretations is as follows:

QUOTIENT	OLIGOTROPHIC	EUTROPHIC
Chlorophycean =		
$\frac{\text{Chlorococcales}}{\text{Desmidiaceae}}$	<1.0	>1.0
Myxophycean =		
$\frac{\text{Myxophyceae}}{\text{Desmidiaceae}}$	<0.4	0.1 - 3.0
Diatom =		
$\frac{\text{Centrales}}{\text{Pennales}}$	<0.3	>0.3
Euglenine =		
$\frac{\text{Euglenine}}{\text{Myxo. + Chlorophyceae}}$	<0.2	0.0 - 1.0
Compound =		
$\frac{\text{Myxo. + Chlor. + Cent. + Euglen.}}{\text{Desmidiaceae}}$	<1.0	2.5

The above indices were applied to the total species found throughout the project, to winter (Diatom Index), and to summer species listings for the entire lake (Table IX). Further applications of the phytoplankton quotients were made on each of the eight stations studied (Table X). Whereas the indices for Stations 1 - 4 represented the combined summer species of 1969 and 1970, those for the more briefly studied Stations 5 - 8 are only for the June through August listings of 1970.

The Diatom and Euglenophyte Indices when applied to the entire lake characterized it as oligotrophic, the Compound Index indicated a mesotrophic state, and the Chlorophycean and Myxophycean Indices indicated eutrophy (Table IX). Use of the five indices on individual stations indicated that Alton Bay, Wolfeboro, and Center Harbor were basically eutrophic, while the Weirs was mesotrophic (Table IX). Although Stations 5 - 8 were only evaluated for one summer, three of the five indices showed mesotrophy at Winter Harbor, Meredith Bay and Paugus Bay; two indicated Melvin Bay as being eutrophic. Whether rating the entire Lake or the individual stations, the five phytoplankton quotients collectively indicated a mesotrophic status for Lake Winnipesaukee. The Compound Index provided the fairer estimate of trophic status, because it incorporated the five major phytoplankton components (i.e. Myxophyceae, Chlorococcales, Centric diatoms, Euglenophyceae, and Desmidiaceae). The Chlorophycean Index values, while greater than 1 in most cases, were borderline ratings. As such, they provided further credence to a mesotrophic ration of Lake Winnipesaukee.

DISCUSSION

Prescott (1951) categorized inland lakes according to their hydrographic features. Lake Winnipesaukee fits well into his category of a soft water drainage lake; that is, one having an inlet and an outlet, and low calcium and half-bound carbon dioxide. The lake is similar to most temperate lakes in that it is dimictic in nature, having both spring and fall overturns (Ruttner, 1963).

The origin of Lake Winnipesaukee probably dates back to the more recent Wisconsin Glaciation Period, the erosive impact of which resulted in the formation of this rock basinned, drift dammed lake (Goldthwait, et al., 1951). Frey (1963) cited calcium values of 2.7 and 3.9 ppm for Lake Winnipesaukee, which agreed with those values recorded for several Wisconsin soft water drainage lakes (Prescott, 1951). Few blue-greens and numerous green algal species were characteristic of most soft water drainage lakes studied by Prescott (1951). The same was true of Winnipesaukee, which had 68 species of blue-green and 237 species of green algae. Prescott (1951) referred to the phytoplankton species of soft water drainage lakes as sparse. He suggested that the relatively high available total nitrogen of such lakes could be coupled with other essential nutrients and might result in greater productivity. A comparison was made between the green and blue-green algal species numbers of Winnipesaukee, and those previously recorded for Lakes Newfound and Winnisquam (Gruendling and Mathieson, 1969). Newfound had 10 blue-green and 43 green taxa, while Winnisquam had 10 blue-green and 93 green taxa. Thus, it is seen that the composition of blue-green and green species of these three lakes is similar to previous findings of Prescott (1951) for other soft water drainage lakes.

An examination of the physical and chemical characteristics of Lake Winnipesaukee (Table I) showed similar findings to those cited by Gruendling and Mathieson (in press). Newfound and Winnisquam Lakes had pH ranges of 6.7 - 7.2 and 6.2 - 7.2 respectively while the Winnipesaukee pH ranged from 7.0 - 7.4. The Methyl orange alkalinity at Winnipesaukee ranged from 6. - 11.6 ppm comparing favorably with the 5. - 9.0 and 5.0 - 11.0 ppm respectively for Newfound and Winnisquam. The above findings, including the CO_2 range of 1 - 6 ppm at Winnipesaukee corresponded with Prescott's (1951) findings at other soft water lakes. Newfound Lake had over 90% oxygen saturation throughout the water column and never had an oxygen deficiency in the hypolimnion. Winnipesaukee had ample oxygen (4.6 - 16.2 ppm) at all depths throughout the year whereas Lake Winnisquam had an oxygen depletion in the hypolimnion during the summer months. The temperature regime at Newfound and Winnisquam was similar to that at Winnipesaukee where the minimal value was recorded beneath the ice (1.9°C), and the maximum was found in late summer (29.3°C) - a typical pattern of most temperate lakes. The 1% light transmission at Winnipesaukee ranged from 5 - 19m at Stations 1 - 8. Similar values were recorded at Newfound. However, the maximal transparency (10m) at Winnisquam was much less than at Winnipesaukee.

Hutchinson (1957) relates the nutrient levels of soft water drainage lakes to the size of the drainage basin, and to the geochemical nature of the surrounding watershed. Since Lake Winnipesaukee has a surface area of 180 km^2 (Frey, 1963) and it drains both sedimentary and igneous type rock (Billings, 1956) the adequate nutrient levels are more easily understood. Most of the silicates, phosphates, and nitrates of lakes are derived from the surrounding mountain ranges and lowlands via the leaching process of water runoff (Hutchinson, 1957).

The nutrient concentrations (phosphates, orthophosphates, silicates and nitrate-nitrogen) found at Winnipesaukee exceeded those values recorded at Newfound and Winnisquam (Gruendling and Mathieson, in press). The nutrients were not limiting factors for algal growth, as seen by the monthly phytoplankton patterns for each station (Figs. 6 and 13). The Weirs and Wolfeboro Stations exhibited the greatest productivity of Stations 1 - 4, with peaks of 13.6 and 9.96 x 10^6 cells/l respectively in August and September of 1969 (Fig. 6). The latter values were much greater than the peak value reported for Newfound (12.7 x 10^5) in August 1966), but they fell far short of the maximum value of 1.7 x 10^8 recorded in September 1967 at Winnisquam Lake (Gruendling and Mathieson, in press). The latter count is easily understood when one realizes the immensity of treated sewage effluent received in Winnisquam daily. The major portion of the phytoplankton (September 1967) at Winnisquam was composed of *Aphanizomenon flos-aquae*.

As one might expect, the highest levels of nutrients appeared during the summer with the influx of tourists, increased boating, swimming, and camping. Particularly conspicuous were the July readings of 49.9 mg/l of orthophosphates and 39.2 mg/l of total phosphates at Meredith Bay. Maximum Myxophycean populations (non-heterocyst forms) usually occur during the summer, and they may exhaust all available nitrates (Prescott, 1951). However, at Winnipesaukee the peaks in nitrate levels occurred during June through August, when maximal numbers of blue-green cells were recorded. The high summer nitrate levels seemed to be a direct result of increased recreational activity. Although sewage treatment occurs in the proximity of most stations studied, their effluent is not stripped of nutrients. In recent years recreational applications have increased so much that temporary closings of major beaches (e.g. Weirs) have occurred. Such closings are contingent upon high coliform counts during the bathing season, and not upon nutrient readings.

It is interesting to note the existence of some potentially *Anabaena scheremetievi*, *Aphanizomenon flos-aquae*, *Coelosphaerium kuetzingianum*, and *Gloeotrichia echinulata* (Jackson, 1964). The latter species may cause conspicuous algal blooms and possibly also obnoxious odors.

Although species diversity is a major characteristic of the Lake Winnipesaukee phytoplankton, the flora might best be referred to as a Myxophycean Plankton, or one dominated by *Polycystis*, *Aphanizomenon*, or *Anabaena* which may form extensive water blooms (Hutchinson, 1967). A summer flora dominated by blue-greens is typical of the more productive lakes of temperate regions and in many shallow tropical watersheds.

The seasonal dominance of Myxophycean cell numbers was evident at all stations. Rarely, as in February, May and June 1970, when blue-green cell numbers were appreciably diminished, did another class (the Bacillariophyceae) dominate the phytoplankton. A few of the organisms contributing significantly to the total Myxophycean Phytoplankton at all stations were *Polycystis aeruginosa*, *Polycystis incerta*, *Coelosphaerium naegelianum*, *Oscillatoria angustissima*, *Coelosphaerium pallidum*, *Gomphosphaeria lacustris* and *Gomphosphaeria lacustris* var. *compacta*.

It is interesting to contrast the Myxophycean dominance in numbers of cells with that of the Chlorophyceae in the number of species. Of the former there were 68 taxa, whereas the latter had 237. Figures 4, 7, 9, 10 and 14 clearly showed the prevalence of green algal species at all stations. The Bacillariophyceae and Cyanophyceae slightly exceeded the greens in numbers of species during January - April 1970 at Alton Bay and

Center Harbor. Rarely did the Chlorophyceae have representative amongst the dominant phytoplankters in numbers of cells. During the summer, Gloeocystis vesiculosa and Botryococcus braunii were common at all stations, and they appeared in significant numbers. Only two other examples of dominance occurred of green algae. The peaks of Actinastrum hantzschii var. fluviatile and Ulothrix variabilis were previously cited.

A comparison was made of the taxa of phytoplankton recorded by Gurendling and Mathieson (1969) for Newfound and Winnisquam Lakes and those found at Winnipesaukee. One hundred taxa were found at Newfound and 142 were found at Winnisquam. Of these, 92 were in common between Newfound and Winnipesaukee and 121 between Winnisquam and Winnipesaukee. The gross similarity of the floras at the three lakes is thus apparent.

A definite seasonal pattern of phytoplankton development occurred at Winnipesaukee with maximal numbers of cells in the summer and minimal winter counts (compare Figs. 6 and 13). The peak at Center Harbor was exceptional in that it occurred during early fall (October). The summer peak of phytoplankton coincided with maximal nutrients and high water temperatures, while the minimal records occurred during periods of ice cover and very low water temperatures (compare Figs. 6 and 13 with Tables I and II).

The green and blue-green algae were the major structural components of the seasonal patterns described above (compared Fig. 3 and Table VII). The Cyanophyceae were usually the second largest contributors to species numbers, except during the winter and spring when the diatoms replaced them. The number of doatom cells in the spring occasionally exceeded those of the Cyanophyceae. The Chrysophyceae generally ranked fourth in numbers of species; they exhibited maximal counts in August of 1969 and 1970. The Cryptophyceae, Dinophyceae, Euglenophyceae, and Xanthophyceae usually composed .5% of the monthly phytoplankton at each station. Thus, the latter classes were of little importance in the overall phytoplankton.

It is obvious that lakes differ both in the quantity and quality of their phytoplankton. Such phenomena led to a trophic system of lake classification based on phytoplankton indices (Nygaard, 1949). Oligotrophy is indicated when algal species are many, phytoplankton numbers are meager, water blooms are rare, and diurnal migration is extensive (Rawson, 1956). The eutrophic state presents the reverse condition. Thus it is seen that lakes may be characterized as being either less productive and more transparent (pH usually less than 7.0, Ca less than 10mg/l), or more productive and less transparent (pH usually over 7.0, Ca more than 10mg/l) as in Nygaard (1949).

Phytoplankton quotients seem of little value by themselves in the determination of trophic levels. As pointed out by Rawson (1956) it is difficult to determine whether edaphic or morphometric factors are more influential in determining oligotrophic levels. It should also be noted that the dominance of an alga, expressed in cell numbers, may not be significant when compared with the total unit and percentage volumes of other species. Likewise, the determination of a trophic level from Chlorococcalean and desmid species numbers seems futile when, for example, 74% of the total phytoplankton is Myxophycean.

The same may be said of the other phytoplankton quotients applied within this text. Even Nygaard's Compound Index which is based on five major groups of algae does not include Chrysophycean species which comprised 7.2 - 30.1% of the phytoplankton found at all of the stations. Rather it might be best to examine trophic levels using a composite of tools, such as the contributions of cell numbers versus cell volumes, the types, abundance and quality of different phytoplankton associations, and the edaphic changes in a water body during successive years.

When the above interpretations are amassed, a fairer estimate of trophic status may be obtained, particularly for those water bodies of a more intermediate trophic level. The collective interpretation of the phytoplankton indices assigns a mesotrophic status to Lake Winnipesaukee. It should be emphasized that the designations of phytoplankton indices are very controversial. Thus, it is felt that a closer look at the coexisting phytoplankton associations peculiar to different trophic levels (Hutchinson, 1967) should also be considered, particularly in bodies of water with transitional trophic levels. Although the principal phytoplankton association at Winnipesaukee is Myxophycean (indicative of eutrophy) there are other associations which are more typical of oligotrophy. Hutchinson (1967) reports an Oligotrophic Desmid Association that is peculiar to slightly acid waters. Ninety-one species of desmids were identified at Winnipesaukee. Newell (1960) and Hoover (1938) both cited lower pH values for Winnipesaukee than those recorded here. Several genera (Sphaerocystis, Gloeocystis, Rhizosolenia, and Tabellaria) typical of the Oligotrophic Desmid Association were frequently found at Winnipesaukee. An Oligotrophic Diatom Association also existed at Winnipesaukee. Unlike the Desmid Association, which was dominant in the numbers of species, the Diatom Association was represented by a dominance in cell numbers of its representative genera. The dominant genera of the Oligotrophic Diatom Plankton were Cyclotella, Tabellaria, and Melosira.

The occurrence of abundant Botryococcus further supports a previous oligotrophic status, for Hutchinson (1967) cites a Botryococcus Association as characteristic of oligotrophic waters. The same may be said of the existence of a well-developed Chrysophycean Plankton; the dominant components being species of Dinobryon. Hutchinson (1967) also speaks of phytoplankton associations peculiar to the more mature waters such as a Eutrophic Diatom Plankton. The latter associations, however, are not as strongly in evidence as the oligotrophic associations cited above.

Hutchinson (1967) characterizes a Chrysophycean Plankton as one peculiar to nutrient depleted waters. However, Lake Winnipesaukee does not seem to have a shortage of nutrients (Table II), and peak numbers of Chrysophyceae occurred during periods of high nutrients (particularly in July through September). Would the Chrysophyceae play an even larger role in the phytoplankton if the recreational pursuits of man were reduced?

Different trophic levels do exist in Lake Winnipesaukee. When a a collective interpretation of the five phytoplankton indices was made (Table IX and X) a mesotrophic status was accorded the Weirs, Winter Harbor, Meredith Bay, and Paugus Bay Stations. The four remaining stations were characterized as eutrophic. The Diatom, Euglenophyte, and Compound Indices characterized Lake Winnipesaukee as either oligotrophic or mesotrophic. The Chlorophycean Index gave an oligotrophic classification to Winter Harbor. It also signified border-line values favoring mesotropny at the Weirs and Meredith Bay and lent further support for their mesotrophic rating.

When the phytoplankton quotients were applied to the entire lake the Chlorophycean and Myxophycean Indices designated a eutrophic rating, whereas the Diatom and Euglenophyte values signified oligotrophy (Table IX). The Compound Index denoted a mesotrophic state. Thus, it is seen that the overall values for the lake compliment those for the individual stations in connoting a mesotrophic evaluation. The borderline values found at many stations further indicated the changing trophic levels of the lake.

Of the four stations characterized as eutrophic (Alton, Wolfeboro, Center Harbor, and Melvin Bay), Wolfeboro showed the largest number of Chlorococcalean species (Table VI). The Chlorophycean and Compound Indices incorporate Chlorococcalean species numbers. Hence, the values recorded for both indices showed that Wolfeboro was second only to Melvin Bay with its rating of eutrophy. Not only did the large number of Chlorococcales (67) and diatom species (55) affect the indices ratings at Wolfeboro, but they also served to augment the Eutrophic Diatom and Chlorococcalean Plankton Associations. Palmer (1969) has compiled a listing (from 165 investigators) of algae tolerant to high organic pollution. He states that organic pollution influences fresh water algal floras more than any other factor. Of particular interest was his listing of the 60 most tolerant genera and the 80 most tolerant species. The Wolfeboro flora had 45 of the genera and 33 of the species listed by Palmer (1969).

SUMMARY AND CONCLUSIONS

The composition, abundance, and seasonal periodicity of the phytoplankton at Lake Winnipesaukee were determined. Eight stations were established in order to identify their phytoplankton floras and trophic levels. The following general conclusions were reached:

1) Lake Winnipesaukee is a dimictic, soft water drainage basin characterized by a Myxophycean Plankton. A large flora was apparent, for 453 taxa were recorded. Two hundred and thirty-seven taxa alone were members of the Chlorophyceae. The Chlorophycean species usually dominated each monthly count.

2) The nutrient levels at Winnipesaukee exceeded all of those previously recorded for Newfound and Winnisquam Lakes, (Gruendling and Mathieson, in press). Thus, aside from adequate nutrients, the most influential factors affecting algal growth were light, temperature, and organic pollution.

3) A typical pattern of phytoplankton abundance was apparent with peak counts occurring in late summer and minimal values during the winter (under ice). The rise or fall of the phytoplankton counts usually coincided with an increase or decrease in nutrient levels, water temperatures, or light penetration.

4) The phytoplankton was primarily comprised of four classes of algae: the Chlorophyceae, Cyanophyceae, Bacillariophyceae, and Chrysophyceae. The Cyanophyceae usually dominated the phytoplankton in the number of cells although not in the number of species.

5) The phytoplankton quotients of Thunmark (1945) and Nygaard (1949) were applied to each station and to the overall lake. A mesotrophic status was accorded the Weirs, Winter Harbor, Meredith, and Paugus Bay Stations. The Diatom and Euglenophyte Indices usually gave oligotrophic

values to the stations, whereas the Compound Index values were mesotrophic for the four stations cited above. The Chlorophycean Index values also approximated a mesotrophic rating. When applied to the entire lake, the indices collectively designated a mesotrophic status to Lake Winnipesaukee. Thus it is seen that different trophic levels may exist in the same lake.

6) The Compound Index was the most useful in designating the trophic levels. The application of this index, together with a knowledge of the phytoplankton associations described by Hutchinson (1967), allowed the fairest evaluation of trophic levels.

7) Alton, Wolfeboro, Center Harbor, and Melvin Bay Stations were classed as eutrophic. Wolfeboro and Melvin Bay were the most striking examples of eutrophy.

8) Of the 100 taxa listed by Gruendling and Mathieson (1969) for Newfound Lake and the 142 taxa cited for Lake Winnisquam, 92 and 121 taxa respectively were common to Winnipesaukee. Thus, the three lakes have similar floras except that Winnipesaukee has a far greater number of species. The greater species diversity and the presence of residual oligotrophic algal associations (Hutchinson, 1967) lend support for postulating a former oligotrophic state of Winnipesaukee.

9) The presence of 45 of the 60 algal genera listed by Palmer (1969) as being most tolerant to organic pollution indicates the large impact of organic pollution in Winnipesaukee. Inadequate treatment of sewage effluent in the vicinity of the stations is indicated.

10) The Weirs Station exhibited the greatest productivity of all the stations. Center Harbor and Winter Harbor were the least productive in total phytoplankton cell counts.

11) Several potentially troublesome taxa of algae (*Aphanizomenon flos-aquae*, *Anabaena flos-aquae*, *Gloeotrichia echinulata*, *Polycystis aeruginosa*, and *Anabaena scheremetievi*) were found throughout the Lake. Further enrichment of the lake may result in serious blooms and obnoxious odors similar to those experienced at Winnisquam.

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Table I

Physical and Chemical Data at Stations 1-8

		pH	O_2	CO_2	HCO_3	Temp. C	1% light trans. pt.
Alton Bay	St. 1	7.0-7.4 (7.2)	7.3-14.2 (8.4)	1.-6. (2.8)	6.-11.1 (8.7)	2.1-26.5	7-18m
Wolfeboro Bay	St. 2	7.0-7.3 (7.2)	4.6-15.3 (8.4)	1.-4. (2.6)	6.4-11.6(8.6)	2.6-26.8	6-19m
Weirs	St. 3	7.0-7.4 (7.2)	5.8-16.2 (8.7)	1.-3. (2.)	6.-9.1 (7.8)	2.6-27.3	5-19m
Center Harbor	St. 4	7.0-7.3 (7.3)	6.9-15.9 (8.8)	1.-4.5 (2.3)	6.2-10.7(8.3)	1.9-27.8	12-17m
Winter Harbor	St. 5	7.2-7.4 (7.3)	7.2-11.3 (8.5)	(2.)	8. -10. (8.7)	- 27.5	- 14m
Melvin Bay	St. 6	7.2-7.3 (7.3)	7.1-10.7 (8.3)	2.-4. (3.)	8. -10. (8.7)	- 29.3	- 14m
Meredith Bay	St. 7	7.2-7.3 (7.3)	7.5-11.2 (8.2)	(2.)	7.-8. (7.7)	- 27.8	- 13m
Paugus Bay	St. 8	7.2-7.3 (7.3)	7.9-12.7 (8.8)	(2.)	8.3-9. (8.7)	- 28.9	- 14m

( ) = average throughout project

Table II

Range of Nutrient Concentrations at Stations 1-8 in mg/l

	1		2		3		4	
Phosphates	(.06-.34)	.2	(.06-.74)	.1	(.06-.26)	.1	(.04-1.)	.
Orthophosphates	(.1-3.73)	.8	(.14-1.98)	.5	(.08-.52)	.2	(.12-1.)	.
Silicates	(1.3-8.4)	2.8	(1.-15.6)	.8	(.6-8.4)	2.4	(.6-3.6)	2.
Nitrate - nitrogen	(.1-1.7)	.6	(.08-1.54)	.5	(.04-1.24)	.5	(.04-1.34)	.

in mg/l

4		5		6		7		8	
(.04-1.)	.2	(.1-.92)	.3	(.08-.26)	.1	(.2-39.2)	10.	(.16-1.38)	.6
(.12-1.)	.3	(.14-1.3)	.6	(.16-.46)	.3	(.38-49.9)	13.	(.34-3.22	1.2
(.6-3.6)	2.4	(1.7-2.8)	2.2	(3.2-28.8)	12.5	(.9-4.3)	1.9	(.7-2.2)	1.8
(.04-1.34)	.6	(.06-1.76)	.6	(.06-.9)	.4	(.02-.38)	.1	(.16-.66)	.4

Table III

Seasonal Occurrence of Phytoplankton at Lake Winnipesaukee

	J	
CHLOROPHYCEAE		
Actinastrum hantzschii var. *elongatum* G. M. Smith.		
Actinastrum hantzschii var. *fluviatile* Schroeder.	2	1,
Actidesmium hookerii Reinsch.		
Ankistrodesmus braunii (Naeg.) Brunnthaler.		
Ankistrodesmus falcatus (Corda) Ralfs.	2-4	1
Ankistrodesmus falcatus var. *acicularis* (A. Braun) G. S. West.	2-4	2
Ankistrodesmus falcatus var. *mirabilis* (West & West) G. S. West.		
Ankistrodesmus falcatus var. *stipitatus* (Chod.) Lemmermann.		
Ankistrodesmus falcatus var. *tumidus* (West & West) G. S. West.	1,2	1
Ankistrodesmus spiralis (Turner) Lemmermann.		
Arthrodesmus constrictus G. M. Smith		
Arthrodesmus incus (DeBreb.) Hass.	1-4	1
Arthrodesmus phimus Turner.		
Arthrodesmus quiriferus W. & G. S. West.		2
Arthrodesmus ralfsii W. West.		
Arthrodesmus ralfsii forma *latiuscula* West & G. S. West.		
Arthrodesmus subulatus Kuetzing.		
Arthrodesmus subulatus var. *nordstedtii* var. *nov* Kuetzing.		
Arthrodesmus triangularis Lagerheim.	1-3	
Arthrodesmus triangularis var. *subtriangularis* (Borge) W. & G. S. West.		
Botryococcus braunii Kuetzing.	1-4	1
Botryococcus protuberans var. *minor* G. M. Smith	1-4	1
Botryococcus sudeticus Lemmermann.		
Bulbochaete scrobiculata (Tiff.) Tiffany.		
Characium gracilipes Lambert.	1	
Characium limneticum Lemmermann.		
Characium stipitatum (Bachm.) Wille.		
Chlamydomonas dinobryonii G. M. Smith		

ukee

1969						1970						
J	A	S	O	N	D	J	F	M	A	M	J	J
										4		
2	1,2,4	2,3	1									2
				4								
					3	3						3
2-4	1-4	2,3	3,4		2,3	1-3		1,3		1,2,4	1-4	1-
2-4	2,4	2		2	2	2				1		
						1						
	2											
1,2	1,2	1.2	1-3	1	1	1	1			1		3
										1		
		3										
1-4	1-4	1-3	1-4	1,2,4	1-3	1,2,4		3,4		4	2,4	1-
			4							1,2		
	2,3				3							3
			1							1,2		1
												2
		1			3						1,2,4	
											3	
1-3										4	1-4	
			2	2	2							
1-4	1-4	1-3	1-4	1,2,4	1-3	1-4	2	3,4		1,4	2-4	1,3
1-4	1-4	2,3	1-4	2,4	1-3	1-4		4		1,2,4	1-4	2,
										2	2	
	3					3					3	
1												
					3							
											1	
										4	1	1

1970

J	F	M	A	M	J	J	A	J	J	A
				4						
						2	2			7
3						3	3		7	
-3		1,3		1,2,4	1-4	1-3	3,4	6,7	6-8	5-8
2				1			2			
1							4			
1	1			1		3	1			7
				1						
2,4		3,4		4	2,4	1-4	1-4	5,6,8	5-8	5-8
				1,2						
						3	3		5,7,8	
				1,2		1		6	5	5,7
						2				
					1,2,4			7		
					3			5,8	7	
				4	1-4		1	5-8		
										5
-4	2	3,4		1,4	2-4	1,3,4	2	6-8	6-8	5-8
-4		4		1,2,4	1-4	2,3	2-4	5-8	5-8	5-8
				2	2			5		
3					3					
							4			5
								7	7	7
					1			6		
				4	1	1				

Table III - continued

	J	
Chlamydomonas polypyrenoideum Prescott.		
Chlamydomonas sphagnicola Fritsch & Takeda.		
Chlorella ellipsoidea Gerneck.		
Chlorella vulgaris Beyerinck.	3	
Cladophora oligoclona Kuetzing.	2	
Closterium aciculare (Tuffen) West.		
Closterium kuetzingii DeBrebisson.	1	
Closterium rostratum Ehrenberg.		
Coelastrum augustae var. *ornatum* Skuja.		
Coelastrum cambricum Archer.		
Coelastrum microporum Naegeli.	1,2,4	1,
Coelastrum scabrum Reinsch.		
Coleochaete pulvinata A. Braun		
Cosmarium bioculatum DeBrebisson.	2,4	1,
Cosmarium bipunctatum Borge.		
Cosmarium contractum Kirchner.		
Cosmarium contractum var. *papillatum* forma *minor* G. M. Smith.		
Cosmarium depressum (Nag.) Lundall.		
Cosmarium moniliforme (Turp.) Ralfs.		
Cosmarium norvegicum Strom.	1-4	1
Cosmarium obtusatum Schmidle.		
Cosmarium ornatum Ralfs.		
Cosmarium phaseolus *breb.* fa. *minor* Boldt.		
Cosmarium punctulatum DeBrebisson.		
Cosmarium scrobicula Kuetzing		
Cosmarium trilobulatum Reinsch.		
Cosmocladium hitchcockii Wolle G. M. Smith	1,2	1,
Crucigenia quadrata Morren.	3,4	3
Crucigenia rectangularis (A. Braun) Gay.	1-4	1
Crucigenia tetrapedia (Kirch.) West & West.	1-4	1
Crucigenia truncata G. M. Smith	1-4	1

1969						1970					
J	A	S	O	N	D	J	F	M	A	M	J
		3									
	2	1	2	2	1,2	1					
3		1,2	3								
2											1
										4	
1					2	2	1	3		1,2,4	2-4
										1,4	
										4	2
		1			3						
1,2,4	1,2,4	2	2,4		2			3,4			2
					3						
2,4	1,2,4	1,2	1,2,4	1		1					
	1			1,4	2	2					
	3		4								
											2,3
1-4	1,4	1,2	4							4	
				4							
	3										
											3
1,2	1,2,4	1,2	1-4	2			2			1	
3,4	3,4	3	3,4	4	3	3,4		3,4		2,4	2-4
1-4	1-4	1-3	1,2,4	2,4	2	2,3	1,2			4	1,2,4
1-4	1,2	1-3	1-4	1,2,4	1-3	1,2	1,2	1		1,2	1
1-4	1-4	1-3	1-4	1,2,4	1-3	1-4	1	1,3,4		2	2,4

1970

J	F	M	A	M	J	J	A	J	J	A
										5,8
						2				
1										
					1					
				4						
2	1	3		1,2,4	2-4	2		5,7,8	5	
				1,4						
								8		
				4	2					
								5	8	
									6	
		3,4			2					
									8	
1							1-3		6	5,6,8
										5
										7
2						3	1-4		8	5-8
						3	1,2,4		7	5,7
					2,3					
				4		3,4	1-3			5,6,8
									5	
							3			
					3					
									7	
	2			1		1-4	1-4		7	5-8
3,4		3,4		2,4	2-4	1,3,4	1-4	5-8	5-8	5-8
2,3	1,2			4	1,2,4	1-4	1-4	5-8	5-8	5-8
1,2	1,2	1		1,2	1	3,4		6-8	6	6,8
1-4	1	1,3,4		2	2,4	3	1	5-8	6-8	6,8

Table III - continued

	J	
Dactylococcus infusionum Naegeli.	2-4	2
Desmidium baileyi (Ralfs) Nordst.		
Desmidium swartzii C. A. Agardh.		
Dictyosphaerium ehrenberghianum Naegeli.		
Dictyosphaerium pulchellum Wood.	1-4	1
Dimorphococcus lunatus A. Braun.		
Dispora crucigenioides Printz.		
Elakatothrix gelatinosa Wille.	2	
Elakatothrix viridis (Snow) Printz.		
Euastrum denticulatum (Kirch.) Gay.	1	
Euastrum pulchellum DeBrebisson.	2-4	2
Eudorina elegans Ehrenberg.	2,3	2
Eudorina unicocca G. M. Smith		
Gloeoactinium limneticum G. M. Smith		
Gloeocystis ampla (Kuetz.) Lagerheim.	1	
Gloeocystis gigas (Kuetz.) Lagerheim.		
Gloeocystis major Gerneck.	3	
Gloeocystis planctonica (West & West) Lemmermann.	2,4	1
Gloeocystis vesiculosa Naegeli.	1,3,4	1
Golenkinia paucispina West & West.		
Golenkinia radiata (Chod.) Wille.	4	1
Gonatozygon aculeatum Hastings.		
Gonatozygon kinahani (Arch.) Rabenhorst.		
Gonatozygon monotaenium DeBary.	4	
Gonatozygon pilosum Wolle.		
Gonium pectorale Mueller.		
Gymnozyga moniliformis ehrenb. forma *maxima* f. nov.		
Hormidium klebsii G. M. Smith		
Hyalotheca dissiliens (Smith) DeBrebisson.		
Hyalotheca mucosa (Dillwyn) Ehrenberg.		
Kerchneriella contorta (Schmidle) Bohlin.		

1969						1970					
J	A	S	O	N	D	J	F	M	A	M	J
2-4	2-4	2,3	2-4	2	2	2					2,4
1-4	3 1-4 1	3 1-3 1,2	1-4 2	1,2,4	1-3 1-3	1-4	2	1,3 3		2 4	1,2 2
2	2	1	1	1	3	1					
1 2-4 2,3	2-4 2,3	2,3 1,3	1-3 1-3	2	3	2,4				4	4 1-3
1	1	3	3 4								3
3 2,4 1,3,4	1,2 1-4	1 1-3	4 2-4	2,4	2,3 3	2 2-4		3		4	2 4
4	1-4	1,2	1-4	1		2				1,2,4	1,3,4
4							2			2,4	3 4 2
		3									
	3	2	3								

1970

J	F	M	A	M	J	J	A	J	J	A
2					2,4				7	
							2			
									8	8
				2		1,3		6	5,7	6,8
1-4	2	1,3		4	1,2	2	1-3	8	5,6,8	5-8
					2	1,3	3,4	8	7	6,7
		3								
1										
						4	1,3,4	6	7,8	7
					4					
2,4				4	1-3	1-3	2-4	5,6	6-8	6-8
							2			
										7
					3			6,7	6,7	7,8
2						2	2		8	
					2				6	7
2-4		3		4	4	1-4	1-4	6-8	5-8	5-8
						1,2,4	4		8	5,8
2				1,2,4	1,3,4	1,2,4	1,2,4	5,7,8	5-8	5-8
										5
					3			5		
	2			2,4	4		2		5	6
					2					5
							4			
									8	
							2			
						1				
							3			

Table III - continued

	J	
Kerchneriella elongata G. M. Smith		
Kerchneriella lunaris (Kirch) Moebius.	2	
Kerchneriella lunaris var. dianae Bohlin.		
Kerchneriella obesa (W. West) Schmidle.	1,2	1,
Kerchneriella obesa var. aperta (Teil.) Brunnthaler.		
Kerchneriella subsolitaria G. S. West		
Micrasterias pinnatifida (Kuetz.) Ralfs.		
Micrasterias radiosa Ralfs.	1	
Micractinium pusillum Fresenius.	1,2	2
Micractinium pusillum var. elegans G. M. Smith		
Mougeotia spp.		1
Nephrocytium agardhianum Naegeli.		
Nephrocytium ecdysiscepanum W. West.		
Nephrocytium limneticum (G. M. Smith) G. M. Smith	1-3	2
Nephrocytium lunatum W. West.		
Nephrocytium obesum West & West.		
Netrium digitus Itzigsohn et Rothe.		
Oedogonium spp.		
Oocystis borgei Snow.		
Oocystis elliptica W. West	1	
Oocystis gigas Archer.	4	
Oocystis lacustris Chodat.	1-4	1
Oocystis nodulosa West & West.	2	
Oocystis parva W. & G. S. West.	1-4	1
Oocystis pusilla Hansgirg.		
Oocystis pyriformis Prescott.		
Palmella mucosa Kuetzing.	2	
Palmodictyon varium (Naeg.) Lemmermann	2	
Palmodictyon viride Kuetzing.	1	
Pandorina morum (Muell.) Bory.	1,2	1
Pediastrum araneosum (Racib.) G. M. Smith		

	1969							1970				
J	A	S	O	N	D	J	F	M	A	M	J	J
2	3	3										
	2										2	
1,2	1,2,4	1,3	1,2	2,4	1,2						2	1-
			3		2,3							
	2	1,2	1-4		3						4	
1							2					
1,2	2,4	1-3	1									2
		1										
	1-3		1,2	1,4	1		2	3		2,4	1-4	1-
		3	2,3	2,4		2					4	1,
1-3	2-4	2,3	1-3	1,4	2,3						3	1,
											2	
											3	1
											4	3
										2		
1	1	1	2		2							
4			4								1	
1-4	1-4	1-3	1-3	1,2,4	1-3	1-4	1,2	1,3,4		1,2,4	1-4	1-
2												
1-4	1-4	1-3	1-4	2,4	1-3	1-4		4		1,2,4	1,4	
			3		4							2
			3									
2	3		3		3	3						4
2												
1												
1,2	1,2	1	3								1,2,4	1,3
										1		

1970

J	F	M	A	M	J	J	A	J	J	A
										6
									8	6
					2			8		
					2	1-4	2,3	8	5,8	6-8
					4		2		6	6
									8	
	2									
						2				8
	2	3		2,4	1-4	1-4	1-4	5-8	5,8	5,6,8
2					4	1,3	2		5,7,8	6,7
									6	
					3	1,4	2,3		5,8	5-8
					2			8		
					3	1			8	7,8
									5	
					4	3		5-7	7	5,7,8
				2			3		8	
							1,2,4		5	5-7
					1		3			5
1-4	1,2	1,3,4		1,2,4	1-4	1-4	1-4	5-8	5-8	5-8
1-4		4		1,2,4	1,4					
						2	3			8
3						4	1,2		6-8	8
					1,2,4	1,3,4	2,3		7,8	5,7,8
				1						

Table III - continued

	J	
Pediastrum araneosum var. rugulosum (G. S. West) G. M. Smith	1,2	
Pediastrum boryanum (Turp.) Meneghini.	1-3	3
Pediastrum duplex Meyen.	1,3	2
Pediastrum duplex var. clathratum (A. Braun) Lagerheim.		
Pediastrum duplex var. cohaerens Bohlin.		
Pediastrum duplex var. gracilimum West & West.	2	
Pediastrum duplex var. reticulatum Lagerheim.	1	
Pediastrum duplex var. rotundatum Lucks.		
Pediastrum duplex var. rugulosum Racibroski.		
Pediastrum kawraiskyi Schmidle.		
Pediastrum sculptatum G. M. Smith		
Pediastrum simplex var. duodenarium (Bailey) Rabenhorst.		
Pediastrum tetras (Ehren.) Ralfs.		1
Pediastrum tetras var. tetraodon (Corda.) Rabenhorst.	1-4	1
Pleodorina californica Shaw.		
Pleurotaenium ehrenberghii (DeBrebisson) Debary.		
Quadrigula chodatii (Tanner-Fullman) G. M. Smith		
Quadrigula closterioides (Bohlin) Printz.	1-4	1
Quadrigula lacustris (Chod.) G. M. Smith	3,4	1
Rhizoclonium spp.		
Scenedesmus acuminatus (Lagerh.) Chodat.		
Scenedesmus acutus f. costulatus (Chod.) Uherkov.		
Scenedesmus arcuatus var. platydisca G. M. Smith	2,3	[illegible]
Scenedesmus bicaudatus (Hansg.) Chodat.	2	
Scenedesmus bijuga (Turp.) Lagerheim.	1	
Scenedesmus bijuga var. alternans (Reinsch) Hansgirg.		[illegible]
Scenedesmus brasiliensis Bohlin.		
Scenedesmus coalitus Hortob.		
Scenedesmus ecornis (Ralfs.) Chodat.	1-4	1
Scenedesmus denticulatus Lagerheim.		
Scenedesmus granulatus W. & G. S. West.		

1969						1970					
J	A	S	O	N	D	J	F	M	A	M	J
1,2			3,4	2,4	1-3	1,3					
1-3	3,4				2,3					4	3,4
1,3	2,3	1		2,4	1-3	2				1,4	3,4
						1					2
2	2										2
1											
											2
											2
											2
		3	3							2	3
	1,2	2,3		2							
1-4	1-4	1-3	1-4	1,4	3	1				4	3
		3				2					
										2	
			4								
1-4	1-4	1,2	1-4	1,2,4	2,3	2				2,4	1,2,
3,4	1-4	1-3	1-4	1,2,4	1-3	1-4	2	3		4	1,3,
				1							
		3									
2,3	3	1,3	1-3		3						2
2											
1											
	3										
			3								
1-4	1-4	1-3	1-4	1,4	1,3	4	3	1			1

1970

J	F	M	A	M	J	J	A	J	J	A
1,3							2,3		6,7	5,6,8
				4	3,4	3,4	2	6	5,7,8	6
2				1,4	3,4	3,4	1,2,4	5,8	5-8	5-8
							2,3		7	
1					2	3				
					2	2	2		5	5
									6	
					2					
					2	4			5,7	6
					2					
				2	3	2	4	6		
								7		6
						4	2,4	6	6,8	5
1				4	3	2,4	1,2,4	5-8	6,8	5-8
2										
				2					5	
							4			
2				2,4	1,2,4	2,3	1,2,4	6,8	5,7,8	5,6,8
1-4	2	3		4	1,3,4	1-4	1-4	5-8	5-8	5-8
										5
						2	3			
						2				
					2		3	8	6	6,7
									6	8
4	3	1			1	1,2,4	1-4	5-8	5,6,8	5-8
							2			6
							2			

Table III - continued

	J	
Scenedesmus incrassatulus Bohlin.	1,3	1,
Scenedesmus incrassatulus var. *mononae* G. M. Smith	2-4	1
Scenedesmus longus var. *naegeli* (DeBreb.) G. M. Smith		
Scenedesmus quadricauda (Turp.) DeBrebisson.		
Scenedesmus quadricauda var. *longispina* (Chod.) G. M. Smith	2	
Scenedesmus quadricauda var. *maximus* West & West.		
Scenedesmus quadricauda var. *parvus* G. M. Smith	3,4	
Scenedesmus quadricauda var. *quadrispina* (Chod.) G. M. Smith		
Scenedesmus quadricauda var. *westii* G. M. Smith		
Scenedesmus quadricauda var. *westii* f. *heterospinous* (Hortob) Uherkov.		
Shroederia ancora G. M. Smith		
Shroederia judayii G. M. Smith	3,4	3
Shroederia setigera (Schroed.) Lemmermann.		
Sphaerocystis shroeteri Chodat.	2-4	1
Sphaerozosma excavata Ralfs.		
Sphaerozosma excavatum var. *subquadratum* (Ralfs.) W. & G. S. West.		
Sphaerozosma exiguum Turner.		
Sphaerozosma granulatum Roy & Bissett.	1,2	1,
Spirogyra spp.		
Spondylosium moniliforme Lundell.		
Spondylosium planum (Wolle) W. & G. S. West.	2,3	
Spondylosium secedens (De Bary) Archer.		
Staurastrum americanum (W. & G. S. West) G. M. Smith	2	
Staurastrum anatinum var. *denticulatum* var. *nov*. G. M. Smith		
Staurastrum anatinum var. *longibrachiatum* W. & G. S. West.		
Staurastrum arctiscon (Ehr.) Lundell.		
Staurastrum brachiatum Ralfs.		
Staurastrum brevispinum DeBisson.		
Staurastrum brevispinum var. *retusum* Borge.		
Staurastrum cumbricum West.		
Staurastrum cuspidatum DeBrebisson.	3,4	1

1969						1970					
J	A	S	O	N	D	J	F	M	A	M	
1,3	1,3,4	3	1,3								
2-4	1-4	1-3	1,2	1,2,4							
2											
3,4											
		2									
						3		3			
3,4	3,4		3,4	4	3	3,4		3		4	3
			3		3	3	2	3		2	
2-4	1-4	1-3	1-4	1	2,3	1,3					2
								4			
							1				
1,2	1,2,4		1,3,4	1,4	1-3	2-4	2	3			
										4	
2,3	3			2	2,3	1-3	1	3,4		1,2	1
	3		2,4	2							
2	3										
			4								
	2										
	1		1-3	4	1-3						
		3			3						
										2	
3,4	1-3	2	4	1,2,4	1,2						

1970

J	F	M	A	M	J	J	A	J	J	A
							1,2	5,7	6,8	6,8
					4	1,2	1,2,4	6-8	6	5,6,8
							2			
						2	1,2			6
						2	2	6	8	
						2				6
					2	2	2	6,7		6
						2		6		
							2			
3		3		4	3,4	1,3,4	1,3,4	5,6,8	5-7	6-8
3,4		3		2	2		2,3	5,8	8	6,8
3	2	3			2,3	1,3,4	2-4	8	7,8	5-8
1,3										
		4								
					3					
						1				
	1					1	2,3	6	5,7	5,7,8
2-4	2	3				1,4	2,3	8	7	5,6
									8	
				4						
1-3	1	3,4		1,2	1-4	1,3,4	2	5,8	7,8	7,8
						3			5	
					3					
					1			8	7	
							2-4			7,8
					4	3			7	
									5	
				2						
						3	3		5-8	7,8

Table III - continued

	J	
Staurastrum denticulatum (Nag.) Arch.	3	
Staurastrum granulosum (Ehrenb.) Ralfs.		
Staurastrum johnsonnii W. & G. S. West.	1-3	1
Staurastrum johnsonnii var. *depauperatum* G. M. Smith		
Staurastrum lacustre G. M. Smith		
Staurastrum leptocladum var. *denticulatum* G. M. Smith		
Staurastrum limneticum Schmidle.	1-3	1
Staurastrum limneticum var. *cornutum* G. M. Smith	2	1
Staurastrum longiradiatum W. & G. S. West		
Staurastrum lunatum Ralfs.		
Staurastrum lunatum var. *planctonicum* W.		
Staurastrum manfeldtii Delp.	1,2	1
Staurastrum megacanthum Lundell.	1-4	1
Staurastrum megacanthum var. *scoticum* W. & G. S. West.		
Staurastrum muticum DeBrebisson.	1,2,4	1
Staurastrum ophiura Lundell.		
Staurastrum orbiculare Ralfs.		
Staurastrum pachyrhynchum Nordst.		
Staurastrum paradoxum Meyen.	1-4	1
Staurastrum paradoxum var. *longipes* Nordst.	1	
Staurastrum paradoxum var. *parvum* W. West.		
Staurastrum pentacerum (Wolle) G. M. Smith.		
Staurastrum pentacerum var. *tetracerum* (Wolle) G. M. Smith.	1-4	1
Staurastrum pingue Teiling.	1-3	
Staurastrum punctulatum var. *kjellmani* Wille.		
Staurastrum setigerum Cleve.		
Staurastrum spiculiferum G. M. Smith		
Staurastrum sublaevispinum W. West.		
Staurastrum subpygmaeum var. *subangulatum* var. *nov.* West.		
Staurastrum tetracerum Ralfs.		
Stichococcus bacillaris Naegeli.		

1969						1970					
J	A	S	O	N	D	J	F	M	A	M	J
3	3	1	1-3	2,4							
										1	
1-3	1,4		2,3	1,4	2,3	3					1-4
	3	3		2	3					4	
			2								
1-3	1,3	1-3	1-4	1,2,4	1-3	1,2	1	1,3			
2	1-3	3	1	2	1,2						
											3
		2	1	1	1						
		3									
1,2	1-3		1-3	4	2						
1-4	1-4	1,3	2-4	2,4	1-4	3		3		4	3,4
		1		2	1,2						
1,2,4	1-3	3	3,4		2	2				1	
										1	
1-4	1-3	1-3	1,2,4	1,2,4	1-3	1		3		1,2,4	1,3,4
1	2			4		2					2
											2
		1									
										1,4	
1-4	1-4	1,3	1,3	1,2,4	2,3	1-4	1	3,4		4	4
1-3	1	3									
			1,3		3						1,3,4
											3
			4	2							2,4
										2	
										2,4	1-3
		3									

1970

J	F	M	A	M	J	J	A	J	J	A
							1,2		5,8	5-8
				1						
3					1-4	1,2	2-4		6-8	5-8
				4		3	1	8		5,7
								5		
1,2	1	1,3				1,2,4	1,3		5,6	5-7
							1-4			5-8
					3					6-8
						1				
						3	2		7	
						1,2,4	1-3		5,6,8	5,7,8
3		3		4	3,4	1-4	1-3		5-8	5-8
						2	3,4			5,7,8
2				1			3,4			5,7,8
				1						
							3			7
						3				
1		3		1,2,4	1,3,4	1,3,4	1-4	5,6,8	6-8	5-8
2					2	1,3,4	1-4			5,8
					2					8
				1,4						
1-4	1	3,4		4	4	1-4	1-4	5,8	5-8	5-8
							1-4	8		8
								8		
					1,3,4	3		8	7,8	5,8
					3					
					2,4	1-3				
				2						
				2,4	1-3		6			

Table III - continued

	J	
Stylosphaeridium stipitatum (Bachm.) Geitler & Gimesi.	1-4	1
Tetraedron asymmetricum Prescott.		
Tetraedron caudatum (Corda) Hansgirg.		
Tetraedron limneticum Borge.	2	
Tetraedron lobulatum var. polyfurcatum G. M. Smith.		
Tetraedron minimum (A. Braun) Hansgirg.	3,4	
Tetraedron muticum fa. punctulatum (Reinsch) DeToni.		
Tetraedron planctonicum G. M. Smith.		
Tetraedron regulare Kuetzing.		
Tetraspora lamellosa Prescott.		
Tetrastrum staurogeniaeforme (Shroeder) Lemmermann.		
Treubaria setigerum (Archer) G. M. Smith.		
Trochiscia obtusa (Reinsch) Hansgirg.		
Ulothrix subconstricta G. S. West.		
Ulothrix subtillissima Rabenhorst.		
Ulothrix variabilis Kuetzing.		
Volvox tertius A. Meyer.		
Westella botryoides (W. West) de Wildemann.		
Westella linearis G. M. Smith		
Xanthidium antilopaeum var. polymazum Nordst.		
Xanthidium cristatum DeBrebisson.		
Xanthidium subhastiferum W. West.		
Zygnema spp.		
BACILLARIOPHYCEAE		
Achnanthes inflata (Kuetzing) Grunow.		
Amphora ovalis Kuetzing.	3	
Asterionella bleakeleyi W. Smith.		
Asterionella formosa Hass.	1-4	1
Asterionella formosa var. gracillima (Hantz.) Grunow.	1-4	2
Caloneis amphisbaena (Bory.) Cleve.		

1969						1970					
J	A	S	O	N	D	J	F	M	A	M	J
1-4	1-4	1-3	1-4	1,2	2,3	1,2	1,2	3,4		2,4	1-4
											3
		2									
2				1,4	3	1				1	2
3,4	1	1,3			3						
		2									
	2										
											4
			3	1							
	3	1,3		2							
	1	1,3	2	2							
											1
										2	
						3					
	1				3			1,3			
										4	2
										4	
			1								
3		1			3	2		4			
										2	
1-4	1-4	1-3	1-4	1,2,4	1-3	1-4	1,2	3,4		1,2,4	1-4
1-4	2,3	1,2	2,3	1,2,4	1-3	1-4	1,2	1,3,4		1,2,4	1,3,4
				2							

1970

J	F	M	A	M	J	J	A	J	J	A
1,2	1,2	3,4		2,4	1-4	1-4	2-4	8	5-8	5-8
					3			7		
1				1	2					7
						4				
								6	6	8
						2				
							2			
						2				5
										6,8
						1				8
					4					
										7
						2	1,2			5-7
					1	1	3		5	7,8
				2						
3										
		1,3					3			
				4	2		3		6,7	5-7
						2				
				4						6,7
										8
2		4								
				2						
1-4	1,2	3,4		1,2,4	1-4	1-4	1-4	5-8	5-8	5-8
1-4	1,2	1,3,4		1,2,4	1,3,4	1-4	1	5-8	5-8	5-8

Table III - continued

	J	
Cocconeis diminuta Ehrenberg.	3	
Cyclotella bodanica Eulenst.	1-4	1
Cyclotella comta (Ehrenberg) Kuetzing.	1-4	1
Cyclotella glomerata Kuetzing.	1	
Cyclotella kuetzingiana W. Smith		
Cyclotella meneghiniana Kuetzing	1-4	1
Cyclotella stelligera Cleve & Grunow.		
Cymatopleura solea (Breb.) W. Smith		
Cymbella affinis Kuetzing.	3	2
Cymbella cistula (Hemp.) Grunow.	4	
Cymbella gracilis (Rabh.) Cleve.		
Cymbella mexicana Ehrenberg.		
Cymbella naviculiformis Auerswold.		
Cymbella obtusiuscula (Kutz.) Grunow.		
Cymbella tumida (Breb.) Van Heurck.		
Cymbella turgida (Greg.) Cleve.		
Cymbella turgidula Grunow.		
Cymbella ventricosa Kuetzing.	1,4	
Diatoma anceps (Ehrenb.) Kirchn.		
Diatoma hiemale (Lyngb.) Hieb.		
Diatoma vulgare Bory		
Diploneis smithii Boyer.		
Eunotia pectinalis (Kuetz.) Rabenhorst.		
Eunotia pectinalis var. *minor* Rabenhorst.		
Eunotia pectinalis var. *minor* forma *impressa* Rabenhorst.		
Eunotia pectinalis var. *undulata* Ralfs.	1	
Fragillaria brevistriata Grunow.	4	
Fragillaria brevistriata var. *inflata* (Pant.) Hustedt.		
Fragillaria brevistriata var. *trigibbe* Grunow.		
Fragillaria construens (Ehrenb.) Grunow.	3	
Fragillaria crotonensis Kitton.	1-3	1

1969						1970					
J	A	S	O	N	D	J	F	M	A	M	J
3	3		3	2,4	3	1,2,4	1	1,4		1,2	1,3
1-4	1-4	1-3	1-4	1,2,4	1-3	1-3	1,2	3,4		1,2,4	1-4
1-4	1-4	1-3	1-4	1,2,4	1-3	1-4	1,2	1,3,4		1,2,4	1-4
1	1		2		2	2					
										2	
1-4	1-4	1-3	1-4	1,2,4	1-3	1-4	1	4		1,2,4	1-4
	4			2	2	2		4			
3	2,3			2	2,3	2		4		2,4	3,4
4			2	2	3						
										1	
											3
	4			4							
1,4	4			4						1,2	2,4
											4
										2	2
										2	
			1	2	1		1				1
			3				1				
						2					
						1,2		4		2	
1	4										
4			3								
						2					
										2	
3											
1-3	1-4	1-3	1-4	1,2,4	1-3	1-4	1,2	3,4		1,2,4	1-4

1970

J	F	M	A	M	J	J	A	J	J	A
,2,4	1	1,4		1,2	1,3	1,4	1,2,4	6-8	5,7	5,7,8
1-3	1,2	3,4		1,2,4	1-4	1,3		6-8	5-8	8
1-4	1,2	1,3,4		1,2,4	1-4	1-4	1-4	5-8	5-8	5-8
2							2			5
				2						
1-4	1	4		1,2,4	1-4	1-4	1-4	6,8	5-8	5,6,8
									6	
2		4								
2		4		2,4	3,4		4	7	7	6
								6		
										5
						3				
				1						
					3					
										5
								8		
				1,2	2,4			5,8	5,8	
					4					
								8		
				2	2					
				2						
	1				1		1			
	1									
2										
1,2		4		2						
2										
				2						
1-4	1,2	3,4		1,2,4	1-4	1-4	1-4	5-8	5-8	5-8

Table III - continued

	J	
Fragillaria intermedia Grunow.	2	
Frustulia rhomboides (Ehr.) DeToni.		
Gomphonema constrictum Ehrenberg.		
Gomphonema olivaceum (Lyngb.) Kuetzing.		
Gyrosigma kuetzingii (Grun.) Cleve.		
Melosira ambigua (Grun.) Mueller.	1-4	2
Melosira distans (Ehrenberg) Kuetzing.	1	
Melosira islandica O. Muller.	1,3,4	3
Melosira italica (Ehrenberg) Kuetzing.		
Meridion circulare (Grev.) Agardh.		
Navicula exigua Greg.		
Navicula rhyncocephala Kuetzing.		
Neidium dubium (Ehrenberg) Cleve.		
Nitzschia acicularis W. Smith	3	
Nitzschia filiformis Hass.	1,2,4	1
Nitzschia holsatica Grunow.	3	3
Nitzschia linearis W. Smith		
Nitzschia macilenta Greg.		
Nitzschia palea (Krasske) W. Smith	3	
Nitzschia sigmoidea (Ehr.) W. Smith.	2	
Opephora martyi Heribaud.		
Pinnularia acrosphaeria DeBrebisson.		
Pinnularia gibba Ehrenberg.		
Pinnularia major (Kuetzing) W. Smith.	1,2	
Pinnularia mesolepta Ehrenberg.		
Pinnularia nobilis Ehrenberg.		
Pinnularia tabellaria Ehrenberg.		
Pleurosigma delicatulum W. Smith.	1,4	
Rhizosolenia eriensis H. L. Smith.	1-4	1
Rhizosolenia eriensis var. *morsa* W. & G. S. West.	1	
Stauroneis acuta W. Smith		
Stauroneis anceps Ehrenberg.		

1969						1970					
J	A	S	O	N	D	J	F	M	A	M	J
2					3					1	1
			2	2	1	2					
					3	2	1	4		2	
							1			1,2	
						1					
1-4	2,3	2,3	1,3,4	1,2,4	1-3	1-4	1,2	1,3,4		1,2,4	1-
1	3	1	1	1		1,2		1,4		1	
1,3,4	3,4		2-4	2,4	2,3	3		3,4		2,4	2-
		2	2	4		1		2			2
			2		2					1	
	4										3
			1								
3	3	3		4	3	3		4		2,4	3
1,2,4	1-3	1,3	1,3,4	2,4	2,3	1,4		3,4			4
3	3,4	1,3	2-4	4	3	1,4		3		4	4
			4								
											2
3	3							4			4
2		2	2	1,4	2	1,2		3		2,4	3,
		1,2	2			1,2					
								4			
1,2			2		2	2				2	
	3		2								
											2
				4							
1,4	2							4			
1-4	1-4	1-3	1-4	1,2,4	1-3	1-4	1,2	3,4		1,2,4	1-
1											
											3
					2						

1970

J	F	M	A	M	J	J	A	J	J	A
				1	1					
2								5	5	5
2	1	4		2						
	1			1,2						
1										
1-4	1,2	1,3,4		1,2,4	1-4	4	2-4	5-8	5-8	5,6,8
1,2		1,4		1				6	6	6
3		3,4		2,4	2-4	4	2	6		5,6
1		2			2					
				1		1		6		
								6		
					3					
3		4		2,4	3			6,8		6
1,4		3,4			4	1,2,4	1-3	8	8	7,8
1,4		3		4	4	3	3	5,6,8	5	5,7
					2					
		4			4			6,7	5,7	5,6
1,2		3		2,4	3,4		4			
1,2										
								7		
		4						8		
2				2						
					2					
									7	
		4								6
1-4	1,2	3,4		1,2,4	1-4	1-4	1-4	5-8	5-8	5-7
					3					

Table III - continued

	J	
Stauroneis phoenicentron Ehrenberg.	2	
Surirella ovalis DeBrebisson.	1	
Surirella ovata Kuetzing.		
Surirella robusta Ehrenberg.		
Synedra actinastroides Lemmermann.	1,2,4	1,
Synedra acus Kuetzing.	1	
Synedra acus var. angustissima Grunow.	2-4	1
Synedra fasciculata (Ag.) Kuetzing.	1	
Synedra parasitica A. Boyer.		
Synedra rumpens Kuetzing.		
Synedra ulna (Nitzsch) Ehrenberg.	1-4	1
Synedra vaucheriae Kuetzing.		
Tabellaria fenestrata (Lyngbye) Kuetzing.	1-4	1
Tabellaria flocculosa (Roth) Kuetzing.	1-4	1
CYANOPHYCEAE		
Anabaena circinalis Rabenhorst.	1-3	1
Anabaena flos-aquae (Lyngb.) DeBrebisson.	1-4	2
Anabaena levanderi Lemmermann.	3	
Anabaena scheremetievi Elenkin.		
Anacystis rupestris (Lyngb.) Drouet & Daily.	1-3	1
Aphanizomenon flos-aquae (L.) Ralfs.	1-3	1,
Aphanocapsa delicatissima West & West.	1-3	1
Aphanocapsa elachista West & West.	1-4	1
Aphanocapsa elachista var. conferta West & West.	4	1
Aphanocapsa elachista var. planctonica G. M. Smith.	1-4	1
Aphanocapsa grevillei (Hass.) Rabenhorst.	2	2
Aphanocapsa rivularis (Carm.) Rabenhorst.	1	
Aphanothece clathrata G. S. West.	1	
Aphanothece gelatinosa (Henn.) Lemmermann.	1-3	2
Aphanothece microscopica Naegeli.	1-4	1

	1969					1970				
J	A	S	O	N	D	J	F	M	A	M
2			3			1				4
1	3	3	2	4	2,3			4		1
						1,2				
			3							
1,2,4	1,2,4	1,2	1,2,4	1,2	1,2	1,2,4	1,2	1,3,4		1,2
1										
2-4	1-4	1-3	1-4	1,2,4	1-3	1-4	1,2	1,3,4		1,2,4
1										
			2							
	1	1								
1-4	1-4	3	2-4	2,4	2	1,2,4	1	4		1,2,4
1-4	1-4	1-3	1-4	1,2,4	1-3	1-4	1,2	1,3,4		1,2,4
1-4	1-4	2,3	1-3	1,4	1,3	1-3		1		1,2
1-3	1-4	1-3	1,3	1,4	1-3		1			1
1-4	2,3	1,3	3,4	2	2	1-4	1	3		
3	3	3	3							
	3	1-3	1,3	1,2	3					
1-3	1-4		1,2,4	1,2,4	1	1,2				
1-3	1,3,4	3	3	2	3	3		1,3		
1-3	1-3	2,3	3		2	3		1		1,4
1-4	1-4	2,3	1-4	2,4	2,3	2-4	1	1		4
4	1-3	1	2-4	2,4	2					
1-4	1-4	1,2	1-4	1,2,4	1	1,4				4
2	2-4	2,3	4	1,2,4	1,2	1-4	1	1		1,2,4
1	1	1,3	1	1	1					
1	3			4	2	1,4				4
1-3	2,3	3	3,4		1,2	1				2,4
1-4	1-4	1-3	1-4	1,4	1-3	2-4		3,4		

1970

J	F	M	A	M	J	J	A	J	J	A
1				4				5		5
		4		1	1,4	4	1,4	6		
1,2									6	
					3					
1,2,4	1,2	1,3,4		1,2	1-4			5-7	6	
1-4	1,2	1,3,4		1,2,4	1-4	1-4	1-4	5-8	5-8	5-8
1,2,4	1	4		1,2,4	1,4	1-3	1,2,4	8	6-8	6,8
								8		
1-4	1,2	1,3,4		1,2,4	1-4	1-4	1-4	5-8	5-8	5-8
1-3		1		1,2	2-4	1,2	1	5,6,8	6,8	6,8
	1			1	4	2,3	1-3			5,7,8
1-4	1	3			1,2,4	1-3	1-4		5-8	5-8
							3			7,8
							3			7,8
1,2					4	1-3	1-4		5-8	5-8
3		1,3			3	2,3	3,4	8		7,8
3		1		1,4					6	5-7
2-4	1	1		4	2,4	1-4	1-4	5,8	5-7	5-8
						4	1,3		7	5-7
1,4				4	1,2	3	2,3	5	5-8	6,7
1-4	1	1		1,2,4	1-4	1-4	1-4	5-8	5-8	5
						1			5	
1,4				4	2,3			5	7,8	
1				2,4	3			6		
2-4		3,4				1-4	1,3,4	5,8	5-8	5-7

Table III - continued

	J	
Aphanothece microspora (Menegh.) Rabenhorst.		
Aphanothece nidulans P. Richter	3	
Aphanothece pulverulenta Bachmann.	3	
Chroococcus dispersus (Keissl.) Lemmermann.	2	
Chroococcus dispersus var. minor G. M. Smith	1	2
Chroococcus giganteus W. West.		
Chroococcus limneticus Lemmermann.	1-4	1
Chroococcus limneticus var. elegans G. M. Smith	1	
Chroococcus minimus (Keissl.) Lemmermann.	1	
Chroococcus minor (Kuetz) Naegeli.	1	
Chroococcus minutus (Kuetz.) Naegeli.		
Chroococcus prescottii Drouet & Daily.		
Chroococcus turgidus (Kuetz.) Naegeli.		
Chroococcus varius A. Braun.	1-4	1
Coelosphaerium kuetzingianum Naegeli.	1	
Coelosphaerium naegelianum Unger.	1-4	1
Coelosphaerium pallidum Lemmermann.	1-4	1
Dactylococcopsis acicularis Lemmermann.		
Dactylococcopsis fascicularis Lemmermann.	2,3	2
Dactylococcopsis rhaphidiodes Hansgirg.	2	
Dactylococcopsis smithii Chodat & Chodat.	1-4	1
Glaucocystis nostochinearum (Itz.) Rabenhorst.		
Gloeocapsa punctata Naegeli.		
Gloeocapsa rupestris Kuetzing.	1-4	2
Gloeothece linearis Naegeli.		
Gloeotrichia echinulata (J. E. Smith) P. Richter.	2	1
Gloeotrichia pisum (C. A. Ag.) Thuret.	1	
Gomphosphaeria aponima Kuetzing.	2	
Gomphosphaeria aponima var. cordiformis Wolle.		
Gomphosphaeria aponima var. delicatula Virieux.	1,3	
Gomphosphaeria aponima var. gelatinosa Prescott.		

1969						1970					
J	A	S	O	N	D	J	F	M	A	M	J
3	3	3	3		3	3		3			3,4
3	3	3	3		2	3					
2	1	1	3								
1	2-4	2,3	3	4	3	4		4			
											4
1-4	1-4	1-3	1-4	2,4	1-3	2,4		3		1	
1											
1	2										
1	1										
	1						1				
	2		1		2						4
1-4	1-4	1-3	1,2,4	1,2,4	3	1,4	2	1		1,4	1
1							1	4			
1-4	1-4	1-3	1-4	1,2,4	1-3	1-4	1,2	3,4		2,4	1-4
1-4	1-4	1-3	1-4	1,2,4	1-3	1-4	1,2	1,3,4		2,4	1-4
		2									
2,3	2,3	1				1					
2		22	2	2	2	2					1
1-4	1-4	1-3	1-4	1,2,4	1-3	2	2	1		2	2,3
		3									
	1		1								
1-4	2-4	1,2	1	1,2,4	2	1,2,4	1,2	1		1	1,2
2	1,4										2
1	2										
2	2	2									4
											4
1,3	1					3					
			4								

1970

J	F	M	A	M	J	J	A	J	J	A
						4				
3		3			3,4	1-4	1-4		5,6,8	5-8
3							4	8		6
						2	1			
4		4					2			5
					4					
2,4		3		1		1-4	1-4	6,8	5,6,8	5-8
							1-4		5-7	5-7
										7
	1						1	6		5
					4		2,3			6
										7
1,4	2	1		1,4	1	3,4	1,2,4	7,8	5,7	5,6,8
	1	4						6		
1-4	1,2	3,4		2,4	1-4	1-4	1-4	5-8	5-8	5-8
1-4	1,2	1,3,4		2,4	1-4	1,3	1-4	8	5-8	5-8
1						1,2				
2					1	1			8	5
2	2	1		2	2,3	1-4	1-4	5-8	5-8	5-8
1,2,4	1,2	1		1	1,2	2,3				6
							2		5,6	
					2		2,4		5,8	
					4					
					4		3			
3						1	3,4			8

Table III - continued

	J	
Gomphosphaeria lacustris Chodat.	2-4	2
Gomphosphaeria lacustris var. *compacta* Lemmermann.	1-4	1
Holopedium irregulare Lagerheim.		
Lynbgya putealis Montagne.		
Marssoniella elegans Lemmermann.	2	
Merismopedia elegans A. Braun.		
Merismopedia elegans var. *major* G. M. Smith.		
Merismopedia glauca (Ehrenb.) Naegeli.	3	2
Merismopedia punctata Meyen.	1	
Merismopedia tenuissima Lemmermann.	2-4	1
Oscillatoria angustissima W. & G. S. Smith	1-4	1
Oscillatoria rubescens De Candolle.		
Oscillatoria splendida Greville.		
Oscillatoria tenuis C. A. Agardh.	1	
Polycystis aeruginosa Kuetzing.	1-4	1
Polycystis incerta Lemmermann.	1-3	1
Rhabdoderma gorskii Woloszynska.		
Rhabdoderma irregulare (Naumann) Geitler.		1,
Rhabdoderma lineare Schmidle & Lauterborn.	3	1
Rhabdoderma sigmoidea fa. *minor* Moore & Carter.	2	
Spirulina major Kuetzing.		
Spirulina princeps (West & West) G. S. West.		
CHRYSOPHYCEAE		
Chrysocapsa planctonica (West & West) Pascher.		
Chrysosphaerella longispina Lauterborn.	1-4	1
Diceras phaseolus Fott.	2,3	2
Dinobryon spp.		
Dinobryon spp.	2	
Dinobryon acuminatum Ruttner.	3,4	2
Dinobryon bavaricum Imhof.	1-4	1

1969						1970					
J	A	S	O	N	D	J	F	M	A	M	J
2-4	2-4	1-3	1-4	1,2	2,3	1,2,4	1	1,3,4		1,2	1-4
1-4	1-4	1-3	1-4	1,2,4	1-3	1,2,4		3,4		2,4	2-4
			3		3			3			3
				1							
2											
	2	2		1							
					3						
3	2-4	2,3	2-4	2,4	2,3	1,2					
1	3			1						4	
2-4	1-4	1-3	1-4	1,2,4	1-3	1,3					3
1-4	1-4	1-3	1-4	1,2,4	1-3	1-4	1	1,3,4		1,4	1-4
			3			2				2	2
1				4		2					
1-4	1-4	1-3	1-4	1,2,4	1-3	2-4	1,2	3,4			2-4
1-3	1-4	1-3	1-4	1,2	1-3	1-4		3,4		1,2	
	1										
	1,2,4	1	1	1				1			1
3	1-3	1-3	3					1			
2	2	2,3									
										4	
		1									
1-4	1-4	1-3	1-4	1,2	1-3	3				1	1,2,4
2,3	2,4	1-3	1-4	1,2,4	2,3	1,2,4	1,2	1,3,4		1,4	1,4
	2										
2	4	2,3								2	3
3,4	2,4		3,4							1,2,4	1
1-4	1-4	1-3	1-4	1,2,4	1-3	1-4	1,2	3,4		1,2,4	1-4

1970

J	F	M	A	M	J	J	A	J	J	A
.,2,4	1	1,3,4		1,2	1-4	1-3	1-3	7,8	5-8	5,6,8
.,2,4		3,4		2,4	2-4	1-4	1-4	5,8	5,7,8	5-8
		3			3					7
						1				
1,2							3,4			
				4		1,2,4	1-4	6	5-8	5-8
1,3					3		3,4		6	
1-4	1	1,3,4		1,4	1-4	1,4	1-4	5,6,8	5-7	5-8
2				2	2			5		
								5		
2							3			8
2-4	1,2	3,4			2-4	1,3	1-4	5,8	5-8	5-8
1-4		3,4		1,2		1,2,4	2-4		6,8	5-8
								1		5,7
		1			1					
		1				1,4	1-4	6,8	5,8	5-8
							1,2	8		
							4			
				4						
										7
3				1	1,2,4	1-4	1-4	5-8	5-8	5-8
.,2,4	1,2	1,3,4		1,4	1,4	2,3	1-3		7,8	6,8
						2-4			5,6,8	5
				2	3	1,2			8	5,6
				1,2,4	1				8	7
1-4	1,2	3,4		1,2,4	1-4	1-4	1-4	5-8	5-8	5-8

Table III - continued

	J	
<u>Dinobryon</u> <u>calciformis</u> Bachmann.		
<u>Dinobryon</u> <u>crenulatum</u> W. & G. West.	3	
<u>Dinobryon</u> <u>cylindricum</u> Imhof.	1-4	1
<u>Dinobryon</u> <u>divergens</u> Imhof.	1-4	1
<u>Dinobryon</u> <u>sertularia</u> var. <u>protuberans</u> Krieger (Lemmermann.)	1-4	1
<u>Dinobryon</u> <u>vanhoeffenii</u> (Krieg.) Bachmann.	1-4	1
<u>Epipyxis</u> <u>tabellariae</u> (Lemm.) Pascher.	3	2
<u>Epipyxis</u> <u>utriculus</u> Ehrenberg.	1	
<u>Hyalobryon</u> <u>mucicola</u> (Lemm.) Pascher.	3	
<u>Mallamonas</u> <u>acaroides</u> Perty.	1,3	
<u>Mallamonas</u> <u>alpina</u> Paschner & Ruttner.	1,2,4	1,
<u>Mallamonas</u> <u>apochromatica</u> Conrad.		
<u>Mallamonas</u> <u>caudata</u> Conrad.	1,2	1
<u>Mallamonas</u> <u>fastigata</u> Zacharias.	1,4	1,
<u>Mallamonas</u> <u>producta</u> Iwanoff.	1,3	
<u>Mallamonas</u> <u>pseudocoronata</u> Prescott.	1-4	1
<u>Mallamonas</u> <u>tonsurata</u> Teiling.	1-4	
<u>Ophiocytium</u> <u>elongatum</u> West & West.		
<u>Ophiocytium</u> <u>mucronatum</u> (A. Braun) Rabenhorst.		
<u>Rhizochrysis</u> <u>limnetica</u> G. M. Smith	1-4	1
<u>Synura</u> <u>adamsii</u> G. M. Smith	3,4	1
<u>Synura</u> <u>petersenii</u> Korshikov.	2,4	
<u>Synura</u> <u>uvella</u> Ehrenberg.	1-4	1
<u>Syncrypta</u> <u>janei</u> nov. sp.		
<u>Uroglena</u> <u>volvox</u> Ehrenberg.	3	
<u>Uroglenopsis</u> <u>americana</u> (Calkins) Lemmermann.	1-4	1
<u>Vaucheria</u> spp.		
DINOPHYCEAE		
<u>Ceratium</u> <u>hirundinella</u> (O. F. Muell.) Dujardin.		
<u>Glenodinium</u> <u>armatum</u> Levander.		

1969						1970					
J	A	S	O	N	D	J	F	M	A	M	J
										4	
3	3	2,3	3,4	4	3	3,4		4			2-4
1-4	1-4	1,3	1-4	1,2,4	1-3	1-4	1,2	3,4		1,2,4	1-4
1-4	1-4	1-3	1-4	1,2,4	1-3	1-4	1,2	1,3,4		1,4	1-4
1-4	1-4	1-3	1-4	1,2,4	1-3	1-4		3		1,2,4	1-4
1-4	1-4	1,3	1-4	1,2,4	1,2	1-4	1,2	3,4		2,4	1-4
3	2,4	2,3	2,3		3	1		4		2,4	1-4
1		3									
3						1		1			
1,3	1	1	3	2	2	1				1,2,4	1,2
1,2,4	1,2,4	3	2-4	2	2,3	2	2	3		2,4	1,2,4
		3								1	
1,2	1,2	1,2	2,4	2	2	3	2	3		1,2	1
1,4	1,3,4	1,3	1,3,4	1	3	3				1,2,4	1-4
1,3	3	1	3	4	1,3	3,4	2	3		4	3
1-4	1-4	1,3	2			1				2,4	1-4
1-4	3					1				1	1
1-4	1-4	1-3	1-4	1,4		3				1,2	1-4
3,4	1,3	1,3	1-4	1,2,4	1-3	2,3	2	3		4	
2,4				2	2,3	2,3	2			1,2	1,2,4
1-4	1-3	1-3	1-4	1,2,4	1-3	1-4	1,2	3,4		1,2,4	1,3,4
		3				4				4	
3						4					
1-4	1-4	1-3	2-4	2,4	2,3	2-4	2	3		1,2,4	1-4
		3		1							1-4

1970

J	F	M	A	M	J	J	A	J	J	A
				4				5		
3,4		4			2-4	1,3,4	4	6-8	5-7	6
1-4	1,2	3,4		1,2,4	1-4	1-4	1-3	5-8	5-8	5-8
1-4	1,2	1,3,4		1,4	1-4	1-4	1-4	5-8	5-8	5-8
1-4		3		1,2,4	1-4	1-4	1-4	5-8	5-8	5-8
1-4	1,2	3,4		2,4	1-4	1-4	1,2,4	5-8	5-8	5-8
1		4		2,4	1-4	1-3	1,2,4	5-8	5-8	6,8
						3,4			6,7	
1		1								
1				1,2,4	1,2	1-3	1	6,8	6-8	5-7
2	2	3		2,4	1,2,4		2	5	7	
				1						
3	2	3		1,2	1	2	2	8	6-8	
3				1,2,4	1-4	3	1,2,4	6-8	5,6	6-8
3,4	2	3		4	3	1,4	2	5,8	8	5-7
1				2,4	1-4	1-4	1-4	5-8	5-8	5,6
1				1	1	1		6	6	
3				1,2	1-4	2,4	1-4	5-8	5-8	5-8
2,3	2	3		4		2,4	2,4	7	6-8	6,7
2,3	2			1,2	1,2,4	3	3	8	7	7
1-4	1,2	3,4		1,2,4	1,3,4	1,4	1,2,4	5-8	5-8	5-8
4				4						7
4						1,2	2			7
2-4	2	3		1,2,4	1-4	1,2,4	2	5-8	6,8	5-8
					1-4	1-4	1-4	5-8	5-8	5-8
						1	1			

Table III - continued

	J	
Glenodinium gymnodinium Penard.	1,2,4	1
Glenodinium palustre (Lemm.) Schiller.	1,3	
Glenodinium pulvisculus (Ehrenb.) Stein.		
Gonyaulax polyedra Stein.		
Gymnodinium fuscum (Ehr.) Stein.		
Gymnodinium palustre Schilling		
Hemidinium nasutum Stein.	1	
Peridinium cinctum (Muell.) Ehrenberg.	1,4	2
Peridinium cinctum var. *tuberosum* (Meunier) Lindemann.		
Peridinium gaslaviense Woloszynska.		
Peridinium inconspicuum Lemmermann.	1,3	
Peridinium limbatum (Stokes) Lemmermann.	1,2	
Peridinium pusillum (Penard) Lemmermann.	1-4	1
Peridinium willei Huitfeld-Kass.		
Peridinium wisconsinense Eddy.		1
CRYPTOPHYCEAE		
Cryptomonas erosa Ehrenberg.	1-4	1
Cryptomonas marssonii Skuja.	3,4	3
Cryptomonas ovata Ehrenberg.	1-4	1
Rhodomonas lacustris Pascher & Ruttner.		2
EUGLENOPHYCEAE		
Euglena gracilis Klebs.	1,4	
Colacium arbuscula Stein.	4	1
Colacium vesiculosum Ehrenberg.	1,2	
Trachelomonas volvocina Ehrenberg.	2	
XANTHOPHYCEAE		
Gloeobotrys limneticus (G. M. Smith) Pascher.		
Ophiocytium elongatum West & West.		

1969						1970					
J	A	S	O	N	D	J	F	M	A	M	J
1,2,4	1-3										2
1,3		3			3					1	1
	2							3			
		3			3						1
1											
1,4	2,3	2,3	1,3	2,4	2,3	2,3	1,2	3,4		1,4	1-3
						1,3,4	1			4	
1,3	3	3									
1,2		1	3	1,2,4	2,3	2,3	1	3		2,4	1-4
1-4	1-4	1-3	2,4	2						2,4	1,2,4
										2	4
	1,3	1									
1-4	1-4	1-3	1,3,4	1,2,4	1-3	1-4	1,2	1,3,4		1,2,4	1-4
3,4	3,4	3	3,4	4	3	4				4	2-4
1-4	1-4	1-3	1-3	1,2,4	1-3	1,3	1	1,3		1,2,4	1,3,4
	2-4	3	4	4	2	3				2	
1,4											2
4	1-3	1,2	2	4						4	4
1,2	3			2,4							4
2					2					2	
								4			

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J	F	M	A	M	J	J	A	J	J	A
					2	1	2		5	6
				1	1	1	2,3	6,7		6,8
								8		
										8
		3					2	5,6,8	8	7
					1			8		
							2			8
2,3	1,2	3,4		1,4	1-3	1-4	1-3	5,6	7,8	5,6,8
1,3,4	1			4				5		
									5	5
						1,2,4	1,3,4	5,6	6,8	6
2,3	1	3		2,4	1-4	1-4	2-4	5,7,8	5,7,8	5-8
				2,4	1,2,4	1-4	1,3,4	5,6,8	5-8	5-8
				2	4	3		5,7	5,8	8
						1	2			5,7,8
1-4	1,2	1,3,4		1,2,4	1-4	1-4	1-4	5-8	5-8	5-8
4				4	2-4	1-4	1-4	5-8	5-8	5-7
1,3	1	1,3		1,2,4	1,3,4	4	2,3	5-7	6,7	6,8
3				2		2-4	1-4	6		6-8
					2		2		5,7	5
				4	4		1,2,4			5-8
					4		3		7,8	5,7,8
				2						
									8	8
		4								

Table III - continued

	J	A
Ophiocytium mucronatum (A. Braun) Rabenhorst.		
Peroniella planctonica G. M. Smith		
Stipitococcus capense Prescott.	3,4	
Vaucheria spp.		

1969						1970					
J	A	S	O	N	D	J	F	M	A	M	J
							2				
3,4	3	1	2,4	1			2			2	

1970

J	F	M	A	M	J	J	A	J	J	A
	2									
						1				
	2			2		2-4	1		5,6,8	5-7

Table IV

Combined Monthly Totals in Numbers of Species Per Class at Stations 1-4

	1969						1970							
	J	A	S	O	N	D	J	F	M	A	M	J	J	A
Chlorophyceae	81	82	82	82	63	69	51	20	28		61	86	92	100
Cyanophyceae	48	48	39	39	32	34	32	14	23		20	29	30	40
Bacillariophyceae	37	31	23	37	31	32	35	18	24		35	33	19	20
Chrysophyceae	26	23	24	20	18	18	24	12	16		24	22	24	21
Dinophyceae	8	7	7	4	4	3	3	3	3		6	7	10	11
Cryptophyceae	3	4	4	4	4	4	4	2	2		4	3	4	4
Euglenophyceae	4	2	1	1	2	1					2	3	0	3
Xanthophyceae	1	1	1	1	1			2	1		1	0	2	1
Total	208	198	181	188	155	161	149	71	97		153	183	181	200

Table V

Combined Monthly Totals in Numbers of Species Per Class at Stations 5-8

1970

	June	July	August
Chlorophyceae	65	97	111
Cyanophyceae	24	28	38
Bacillariophyceae	33	24	27
Chrysophyceae	21	25	24
Dinophyceae	11	9	13
Cryptophyceae	4	3	4
Euglenophyceae	0	1	3
Xanthophyceae	1	2	2
Total	159	189	222

Table VI

Total Number of Species per Class at Each Station

Lake Winnipesaukee

	1	2	3	4	5	6	7	8
Chlorophyceae	118	138	121	103	86	81	87	92
Bacillariophyceae	44	55	36	40	22	28	19	21
Cyanophyceae	49	46	43	44	33	30	31	30
Chrysophyceae	28	27	28	27	20	21	23	22
Dinophyceae	10	7	11	10	11	8	8	13
Cryptophyceae	4	4	4	4	3	4	4	4
Euglenophyceae	3	4	2	3	3	1	2	2
Xanthophyceae	3	2	1	2	2	1	1	2
Total	259	283	246	233	180	174	175	186

Table VII

Monthly Totals of Species Found at Each Station

	J	A	S	O	N	D	J	F	M	A	M	J	J	A
Station No. 1	116	108	113	92	84	70	83	52	35	-	74	83	108	107
2	126	127	104	113	107	103	93	46	-	-	97	101	102	126
3	108	131	126	129	118	-	77	-	67	-	-	89	102	118
4	102	102	103	-	104	-	63	-	59	-	98	102	92	104
5												78	83	109
6												95	89	131
7												69	112	112
8												107	110	113

Table VIII

Percent Composition of Total Cell Numbers Per Classes at Sta

	1969 J	A	S	O	N	D	1970 J	F	M	A
Chlorophyceae	12.	08.	09.	05.	04.	02.	03.	07.	04.	--
Cyanophyceae	76.	77.	77.	90.6	90.	86.	76.	51.	84.	
Bacillariophyceae	10.	03.1	03.	02.	03.	09.	18.1	40.	10.6	
Chrysophyceae	1.	11.	10.1	02.	02.7	02.6	02.7	01.6	00.8	
Dinophyceae	.1	00.2	00.2	-	-	-	-	-	-	
Cryptophyceae	.3	00.6	00.6	00.3	00.2	00.3	00.1	00.3	00.5	
Euglenophyceae	-	-	-	-	-	-	-	-	-	
Xanthophyceae	-	-	-	-	-	-	-	-	-	
Chlorophyceae	20.	08.	05.	03.	06.	04.	03.	11.2		
Cyanophyceae	62.	81.4	89.4	90.8	84.7	84.6	77.4	10.		
Bacillariophyceae	09.5	03.	02.3	05.	06.	07.2	18.4	45.		
Chrysophyceae	08.	07.	03.	01.	03.	04.	01.	33.		
Dinophyceae	00.2	00.1	-	-	-	-	-	-		
Cryptophyceae	00.2	00.4	00.2	00.1	00.2	00.1	-	00.6		
Euglenophyceae	-	-	-	-	-	-	-	-		
Xanthophyceae	-	-	-	-	-	-	-	-		
Chlorophyceae	06.	06.5	06.4	05.		04.	02.		03.2	
Cyanophyceae	79.7	90.	81.	89.4		75.3	78.		73.	
Bacillariophyceae	06.	02.	05.	02.3		10.2	17.2		17.	
Chrysophyceae	08.	01.	07.	03.		10.	02.6		06.5	
Dinophyceae	-	-	00.1	-		-	-		-	
Cryptophyceae	00.2	00.3	00.4	00.2		00.3			00.1	
Euglenophyceae	-	-	-	-		-	-		-	
Xanthophyceae	-	-	-	-		-	-		-	

Table VIII

ion of Total Cell Numbers Per Classes at Stations 1-8

N	D	1970 J	F	M	A	M	J	J	A	Yearly Av.	
04.	02.	03.	07.	04.		05.	07.	04.	12.	6.3	
90.	86.	76.	51.	84.		41.	47.	68.	85.	73.	
03.	09.	18.1	40.	10.6		33.	23.	12.	02.	13.	St. 1
02.7	02.6	02.7	01.6	00.8		20.	22.2	15.2	00.7	7.2	
-	-	-	-	-		00.1	00.2	00.5	00.1	.1	
00.2	00.3	00.1	00.3	00.5		00.8	00.5	00.2	00.1	.3	
-	-	-	-	-		-	-	-	-	-	
-	-	-	-	-		-	-	-	-	-	
06.	04.	03.	11.2			03.	07.	16.	06.	7.7	
84.7	84.6	77.4	10.			23.6	43.	46.	76.6	65.9	
06.	07.2	18.4	45.			44.	20.6	09.	02.	14.	St. 2
03.	04.	01.	33.			29.	29.	27.4	15.	12.	
-	-	-	-			-	00.1	01.	00.1	.1	
00.2	00.1	-	00.6			00.2	00.2	00.4	00.1	.2	
-	-	-	-			-	-	-	-	-	
-	-	-	-			-	-	-	-	-	
	04.	02.		03.2			10.	07.1	10.	6.	
	75.3	78.		73.			21.	69.1	88.2	74.	
	10.2	17.2		17.			44.6	14.	01.2	12.	St. 3
	10.	02.6		06.5			24.	09.	00.3	7.5	
	-	-		-			-	00.1	-	-	
	00.3			00.1			00.2	00.5	00.1	.2	
	-	-		-			-	-	-	-	
	-	-		-			-	-	-	-	

Table VIII - continued

	J	A	S	O	N	D	J	F	M	A
Chlorophyceae	07.	06.		07.3	05.		09.		06.3	
Cyanophyceae	78.2	77.3		77.2	79.1		66.4		66.4	
Bacillariophyceae	03.2	03.1		03.2	02.1		13.2		21.	
Chrysophyceae	11.	13.		12.	13.4		11.1		06.	
Dinophyceae	00.1	00.1		-	-		-		-	
Cryptophyceae	00.3	00.4		00.1	00.2		00.1		-	
Euglenophyceae										
Xanthophyceae										

		St. 5		Y.A.		St. 6		Y.A.		St. 7
	J	J	A		J	J	A		J	J
Chlorophyceae	09.	02.4	08.	6.4	23.	14.2	09.	15.3	09.3	08.1
Cyanophyceae	42.	82.1	70.3	64.6	12.1	74.1	78.1	54.6	14.2	68.2
Bacillariophyceae	35.	10.2	05.4	16.6	27.2	05.2	03.2	11.6	47.	14.1
Chrysophyceae	13.2	05.	16.	12.	36.	06.	09.3	17.7	29.	08.2
Dinophyceae	00.2	00.1	00.1	.1	00.2	00.1	-	.1	00.1	-
Chrptophyceae	00.4	00.1	00.1	.2	01.4	00.3	00.3	.6	00.2	01.2
Euglenophyceae	-	-	-	-	-	-	-	-	-	-
Xanthophyceae	-	-	-	-	-	-	-	-	-	-

- = <.1%

ntinued

J	F	M	A	M	J	J	A	Yearly Average	
09.		06.3		15.5	07.1	08.	06.	7.7	
66.4		66.4		22.1	59.2	67.	78.	66.9	
13.2		21.		30.	21.	09.	03.	11.	St. 4
11.1		06.		32.	12.1	15.	12.7	14.	
-		-		00.1	00.1	00.3	-	-	
00.1		-		00.1	00.3	00.6	00.2	.2	
								-	
								-	

	Y.A.		St. 7		Y.A.		St. 8		
A		J	J	A		J	J	A	Av.
09.	15.3	09.3	08.1	05.1	7.	18.	15.	07.2	13.3
78.1	54.6	14.2	68.2	82.5	55.5	48.2	64.	62	58.7
03.2	11.6	47.	14.1	02.	21.3	22.4	06.	00.4	9.7
09.3	17.7	29.	08.2	10.	15.6	11.	14.2	30.1	18.
-	.1	00.1	-	-	-	00.1	00.1	-	-
00.3	.6	00.2	01.2	00.2	.5	00.2	00.4	-	.2
-	-	-	-	-		-	-	-	-
-	-	-	-	-		-	00.1	-	-

Table IX

Summary of Phytoplankton Indices and Proposed Trophic Status of

Lake Winnipesaukee

	Composite	Summer	Winter	Trophic Status
Chlorophycean Index	1.34	1.37	-	eutrophic
Myxophycean Index	.79	.83	-	eutrophic
Diatom Index	.14	.14	.17	oligotrophic
Euglenophyte Index	.01	.02	-	oligotrophic
Compound Index	2.40	2.37	-	mesotrophic

Table X

Summary of Phytoplankton Indices and Proposed Trophic Status for Stations 1-8

	1	2	3	4	5	6	7	8
Chlorophycean Index	1.11	1.63	1.02	1.29	.89	1.96	1.03	1.20
	E	E	E	E	O	E	E	E
Myxophycean Index	1.28	1.07	.85	1.19	.94	1.30	.86	.86
	E	E	E	E	E	E	E	E
Diatom Index	.33	.30	.22	.21	.38	.42	.27	.24
	E	O	O	O	E	E	O	O
Euglenophyte Index	.022	.024	.013	.024	.025	.009	.025	.016
	O	O	O	O	O	O	O	O
Compound Index	2.67	2.95	2.04	2.74	2.09	3.65	2.08	2.23
	E	E	M	E	M	E	M	M

E denotes eutrophy O denotes oligotrophy M denotes mesotrophy

FIGURE I

MAP OF LAKE WINNIPESAUKEE, NEW HAMPSHIRE

LEGEND FOR FIGURE I

Stations:

1. Alton Bay
2. Wolfeboro Bay
3. Weirs
4. Center Harbor
5. Winter Harbor
6. Melvin Bay
7. Meredith Bay
8. Paugus Bay

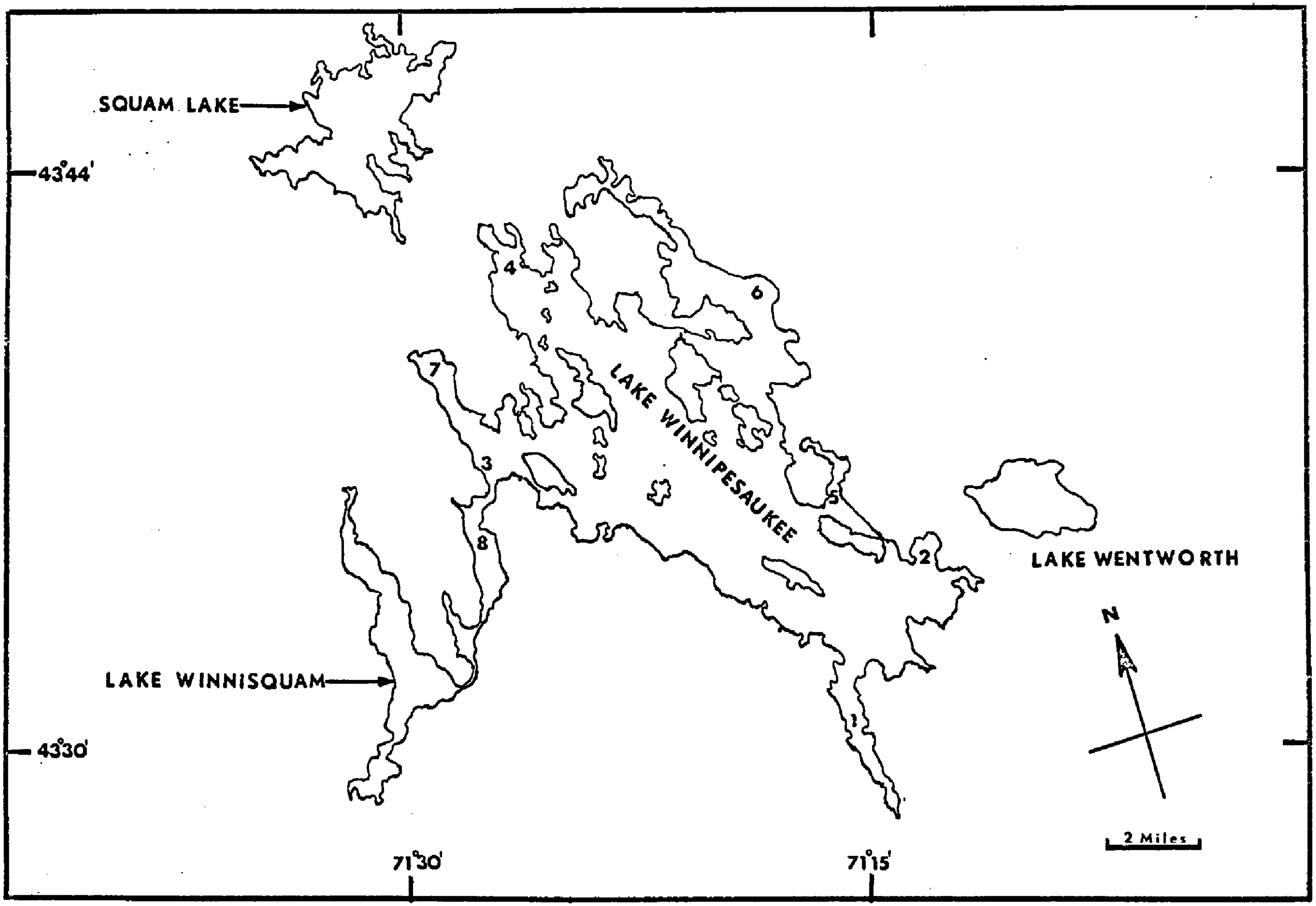
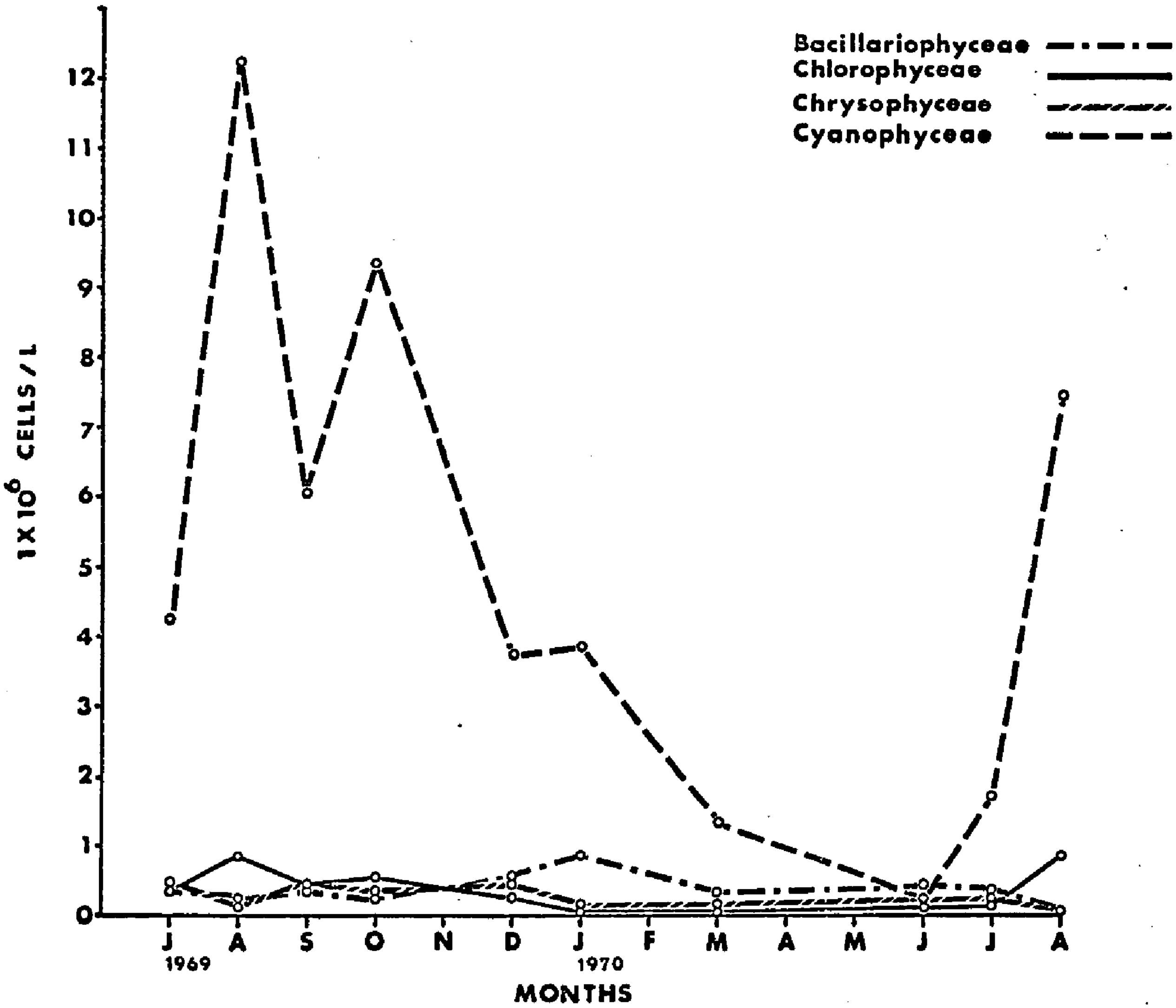

SQUAM LAKE
43°44'
43°30'
LAKE WINNIPESAUKEE
LAKE WENTWORTH
LAKE WINNISQUAM
71°30'
71°15'
N
2 Miles
1
2
3
4
5
6
7
8

FIGURE 2

MONTHLY VARIATION IN NUMBERS OF CELLS

PER CLASS AT STATION 3

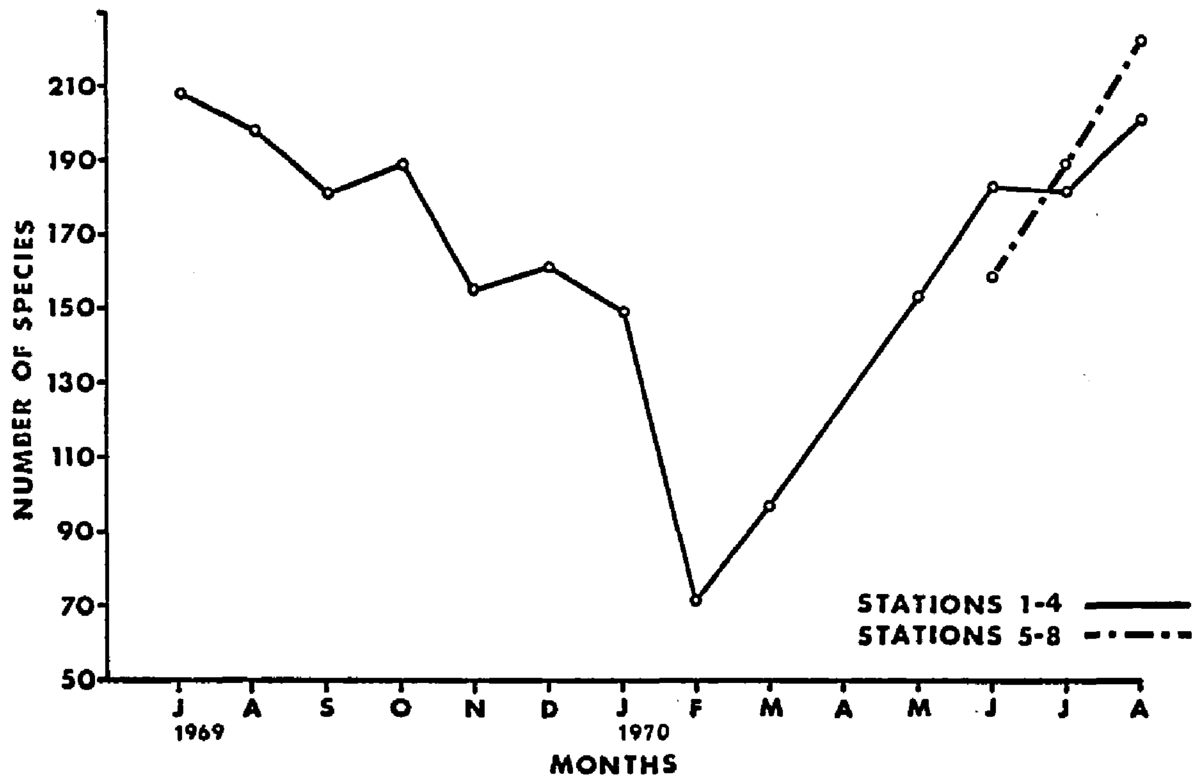


Bacillariophyceae
Chlorophyceae
Chrysophyceae
Cyanophyceae
1 X 10^6 CELLS / L
0
1
2
3
4
5
6
7
8
9
10
11
12
J
A
S
O
N
D
J
F
M
A
M
J
J
A
1969
1970
MONTHS

FIGURE 3

MONTHLY VARIATION IN NUMBERS OF SPECIES

AT ALL STATIONS

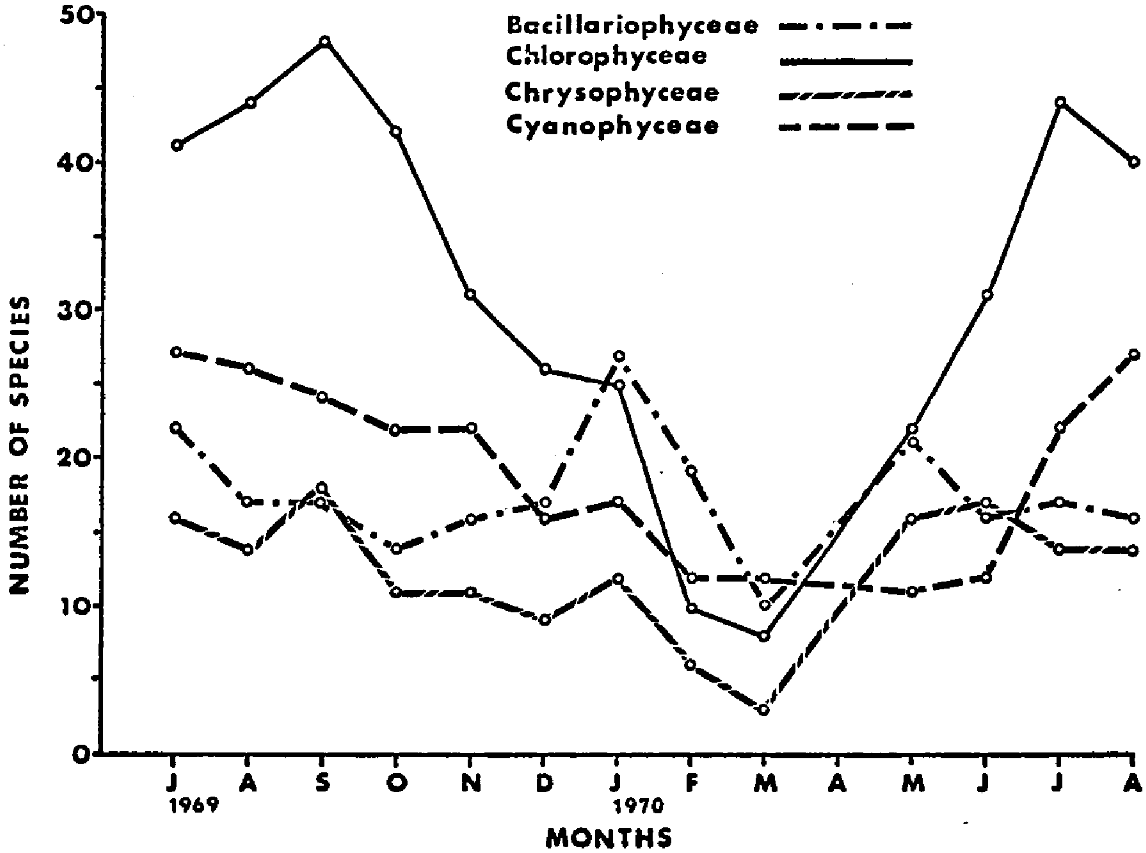


NUMBER OF SPECIES
210
190
170
150
130
110
90
70
50
J
A
S
O
N
D
J
F
M
A
M
J
J
A
1969
1970
MONTHS
STATIONS 1-4
STATIONS 5-8

FIGURE 4

SEASONAL VARIATION IN NUMBERS OF SPECIES

PER CLASS AT STATION 1

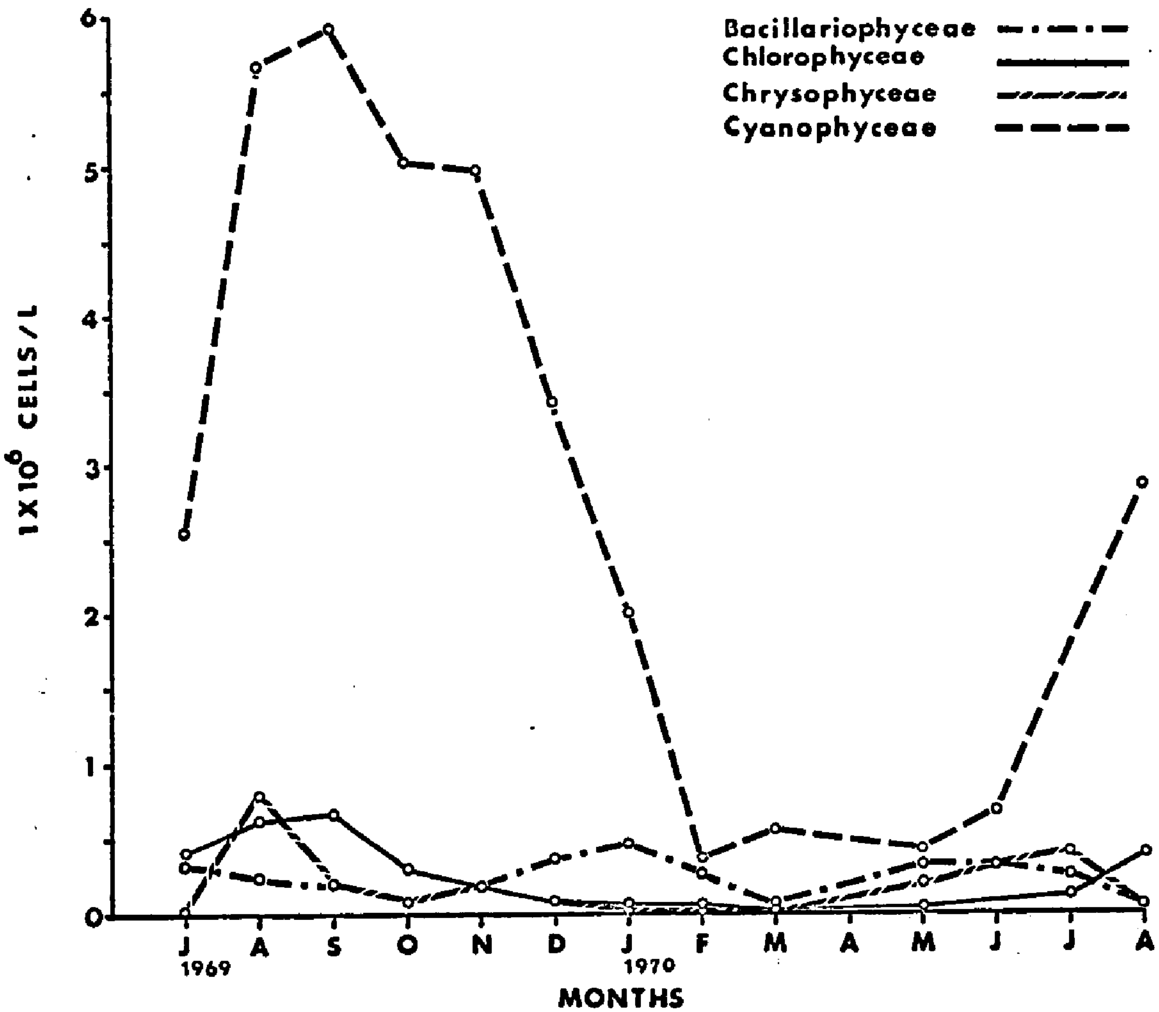


Bacillariophyceae
Chlorophyceae
Chrysophyceae
Cyanophyceae
NUMBER OF SPECIES
50
40
30
20
10
0
J A S O N D J F M A M J J A
1969
1970
MONTHS

FIGURE 5

MONTHLY VARIATION IN NUMBERS OF CELLS

PER CLASS AT STATION 1

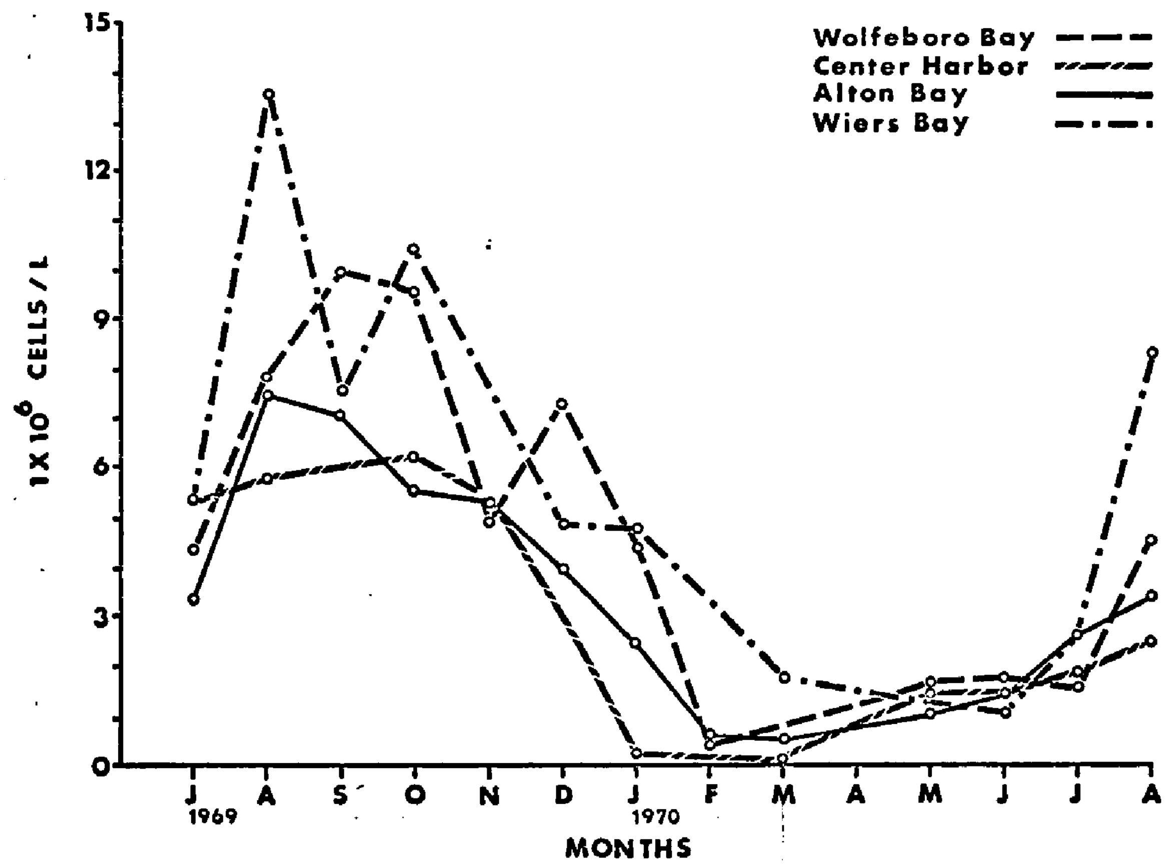


Bacillariophyceae
Chlorophyceae
Chrysophyceae
Cyanophyceae
1×10^6 CELLS / L
0
1
2
3
4
5
6
J
1969
A
S
O
N
D
J
1970
F
M
A
M
J
J
A
MONTHS

FIGURE 6

SEASONAL VARIATION IN NUMBERS OF CELLS

AT STATIONS 1 - 4



Wolfeboro Bay
Center Harbor
Alton Bay
Wiers Bay
1 X 10^6 CELLS / L
15
12
9
6
3
0
J A S O N D J F M A M J J A
1969
1970
MONTHS

FIGURE 7

SEASONAL VARIATION IN NUMBERS OF SPECIES

PER CLASS AT STATION 2

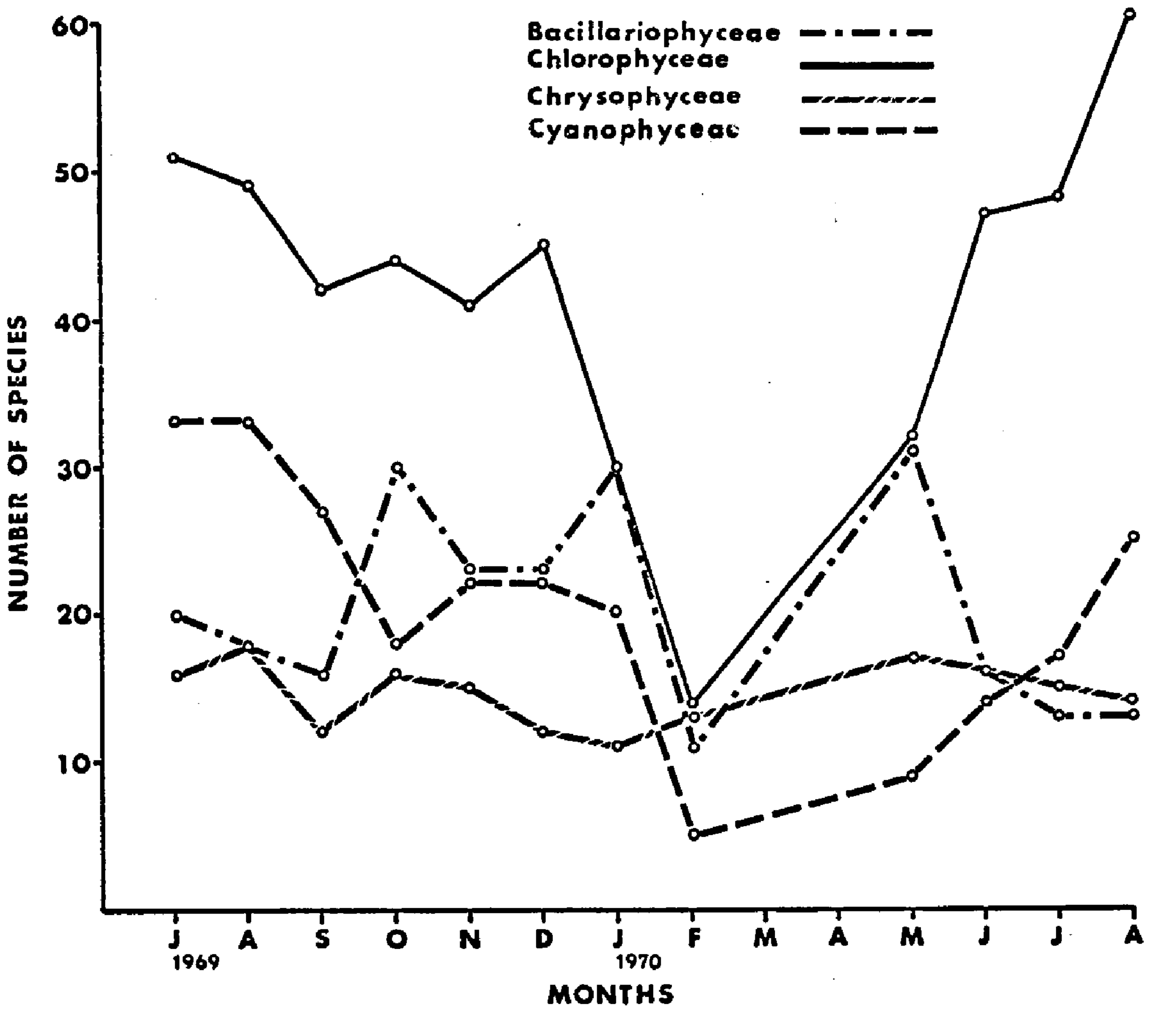
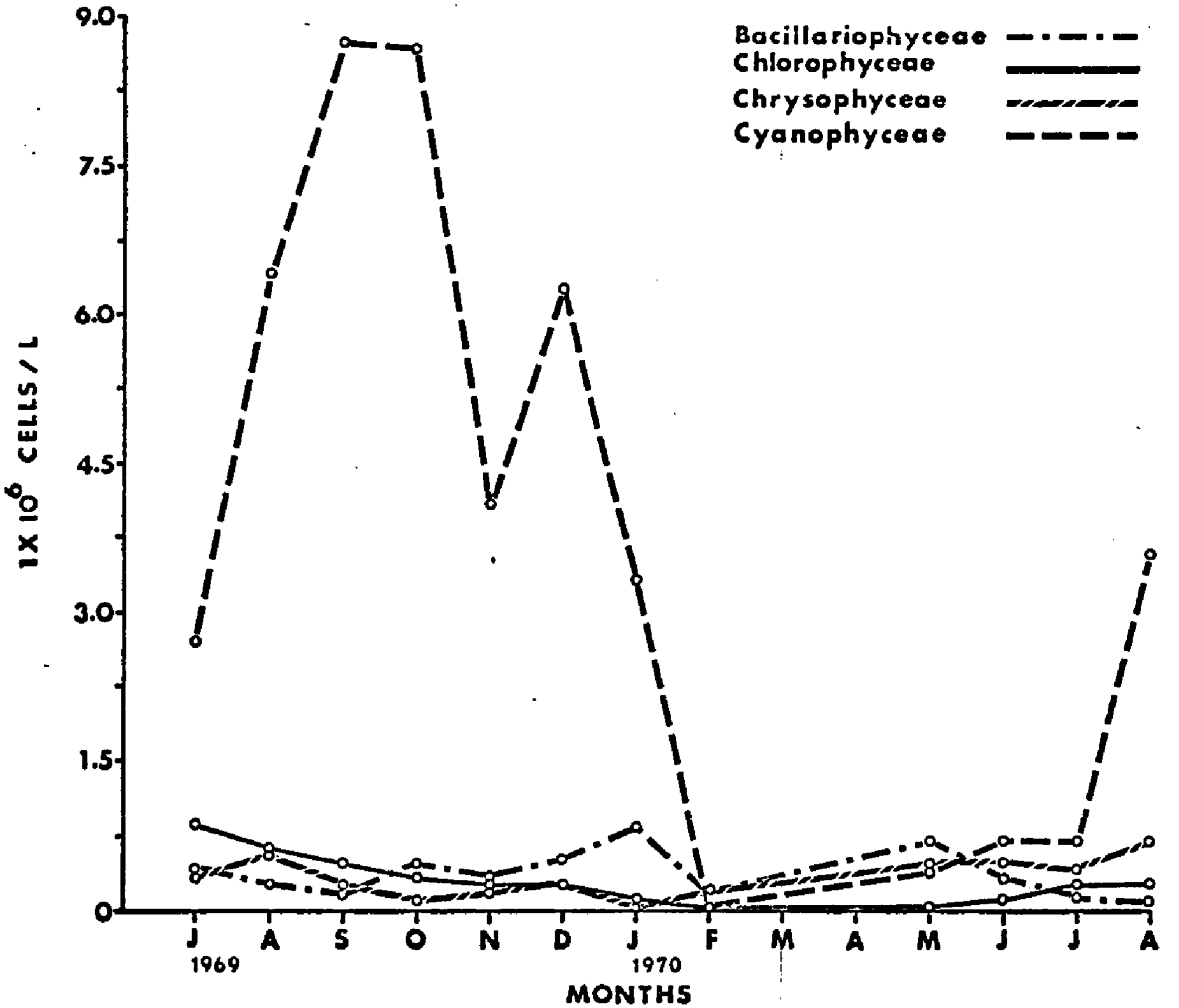

Bacillariophyceae
Chlorophyceae
Chrysophyceae
Cyanophyceac
NUMBER OF SPECIES
60
50
40
30
20
10
J
1969
A
S
O
N
D
J
1970
F
M
A
M
J
J
A
MONTHS

FIGURE 8

MONTHLY VARIATION IN NUMBERS OF CELLS

PER CLASS AT STATION 2

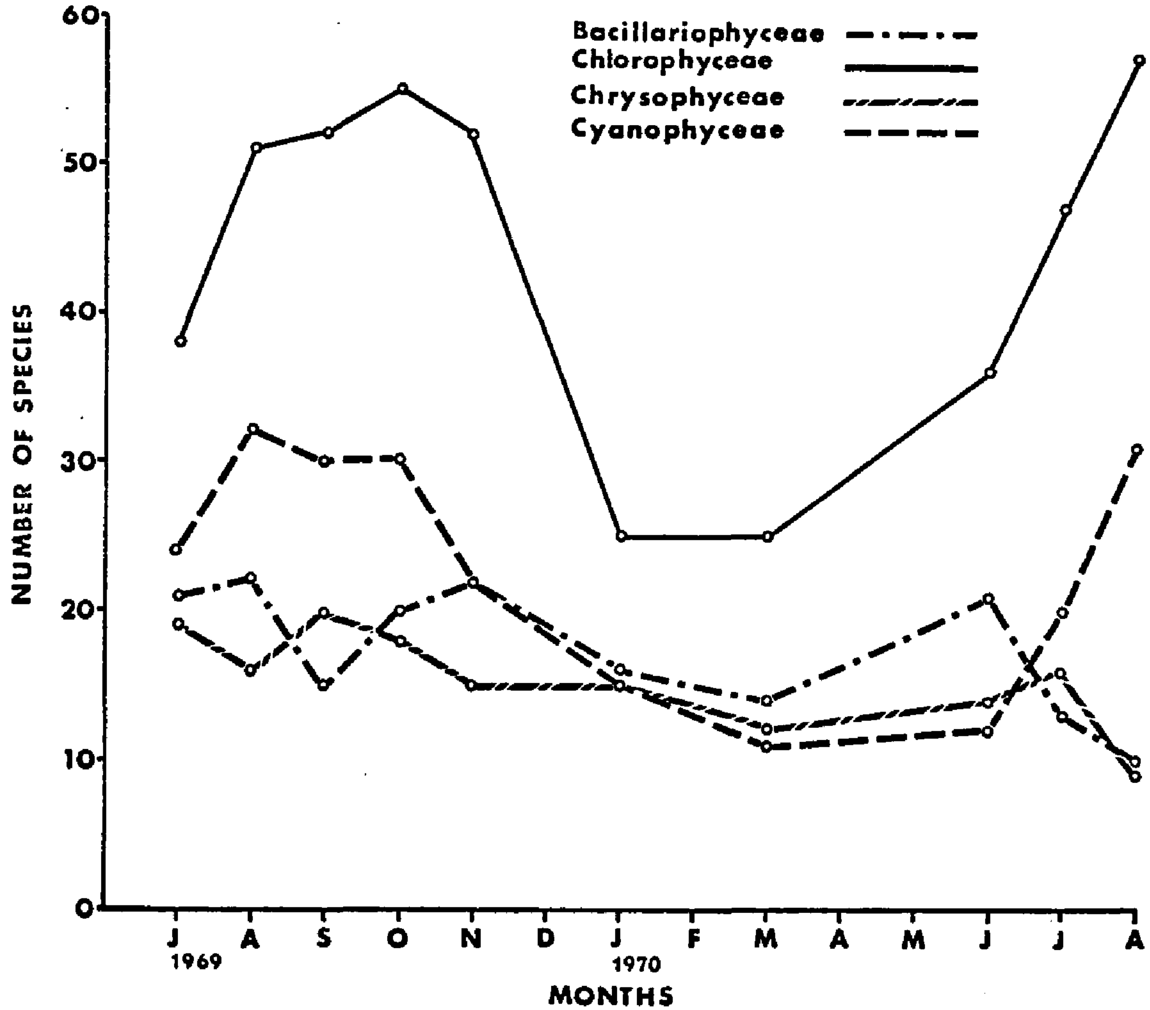


Bacillariophyceae
Chlorophyceae
Chrysophyceae
Cyanophyceae
9.0
7.5
6.0
4.5
3.0
1.5
0
1 X 10^6 CELLS / L
J
A
S
O
N
D
J
F
M
A
M
J
J
A
1969
1970
MONTHS

FIGURE 9

SEASONAL VARIATION IN NUMBERS OF SPECIES

PER CLASS AT STATION 3



Bacillariophyceae
Chlorophyceae
Chrysophyceae
Cyanophyceae
NUMBER OF SPECIES
60
50
40
30
20
10
0
J
A
S
O
N
D
J
F
M
A
M
J
J
A
1969
1970
MONTHS

FIGURE 10

SEASONAL VARIATION IN NUMBERS OF SPECIES

PER CLASS AT STATION 4

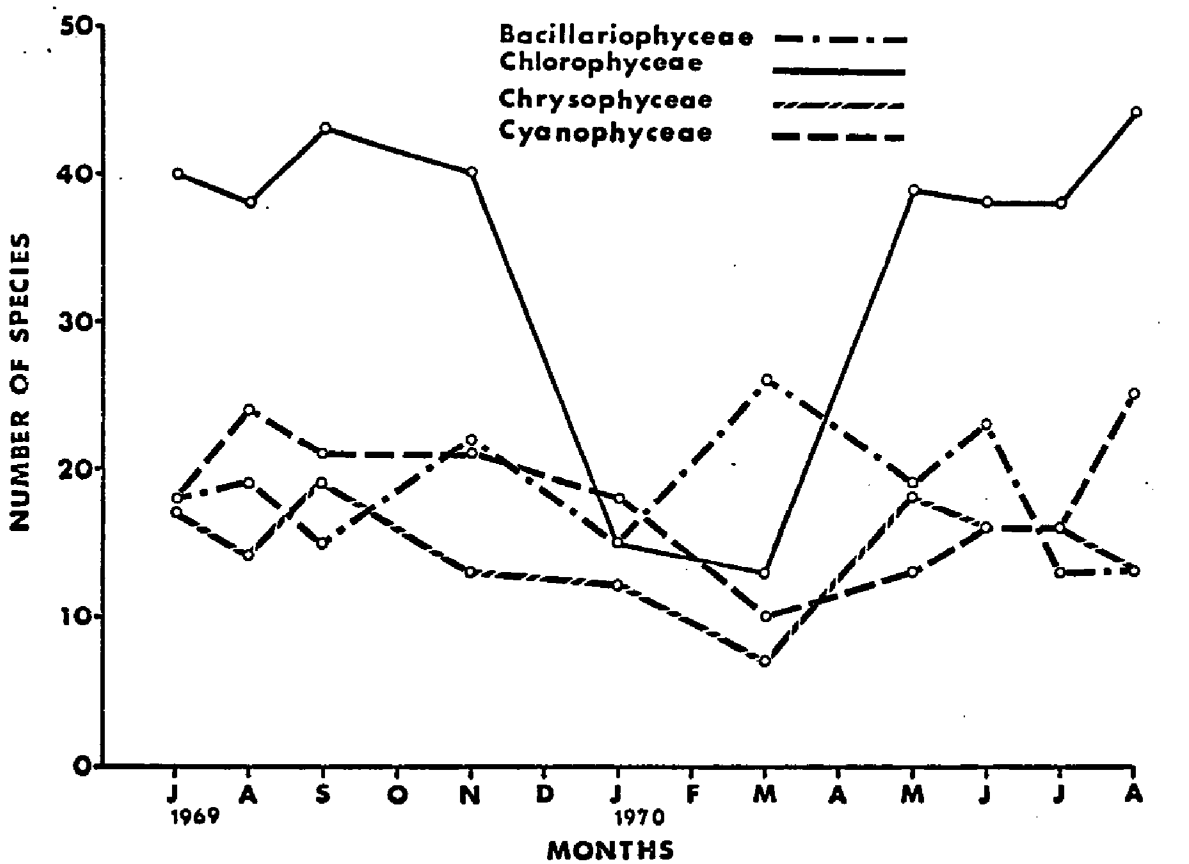
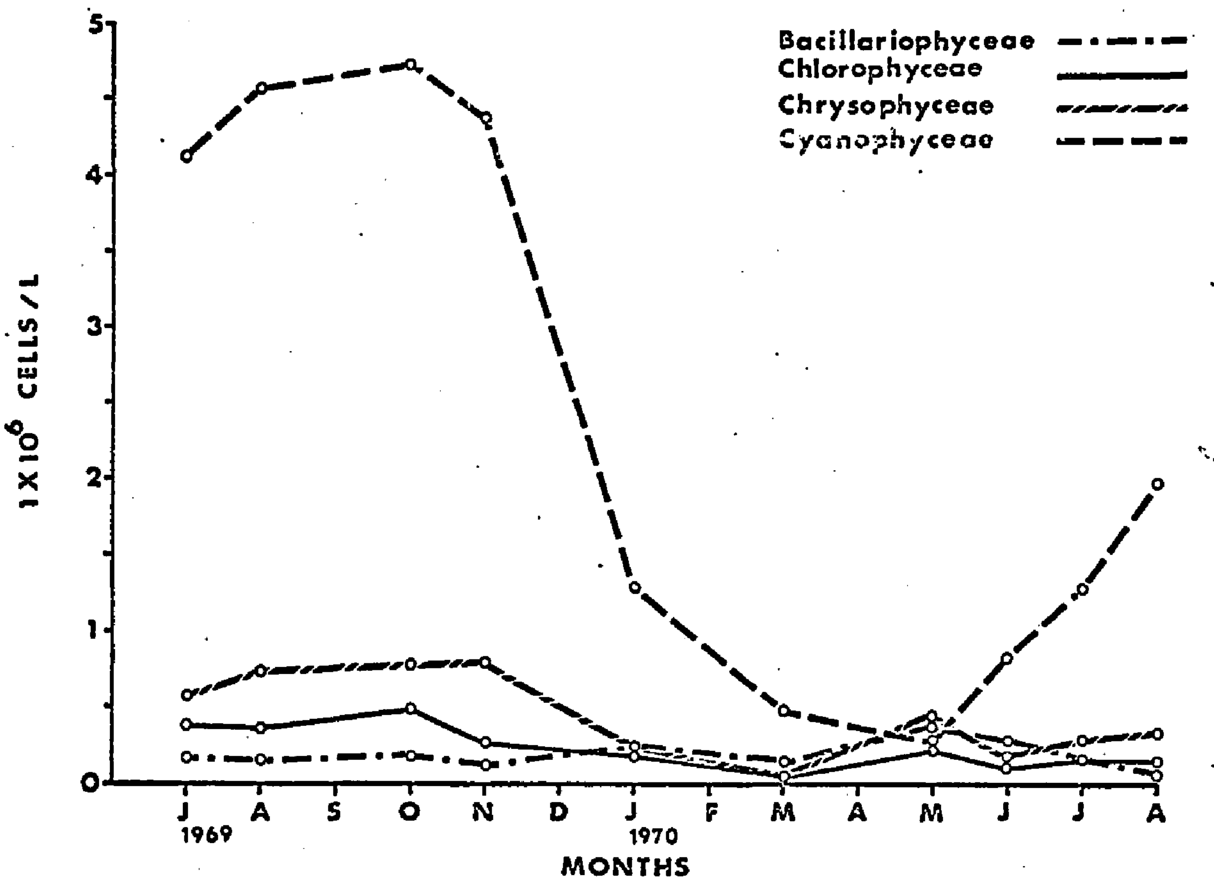

Bacillariophyceae
Chlorophyceae
Chrysophyceae
Cyanophyceae
NUMBER OF SPECIES
0
10
20
30
40
50
J
A
S
O
N
D
J
F
M
A
M
J
J
A
1969
1970
MONTHS

FIGURE 11

MONTHLY VARIATION IN NUMBERS OF CELLS

PER CLASS AT STATION 4



Bacillariophyceae
Chlorophyceae
Chrysophyceae
Cyanophyceae
1 X 10^6 CELLS / L
0
1
2
3
4
5
J
A
S
O
N
D
J
F
M
A
M
J
J
A
1969
1970
MONTHS

FIGURE 12

MONTHLY VARIATION IN NUMBERS OF CELLS

PER CLASS AT STATIONS 5 - 8

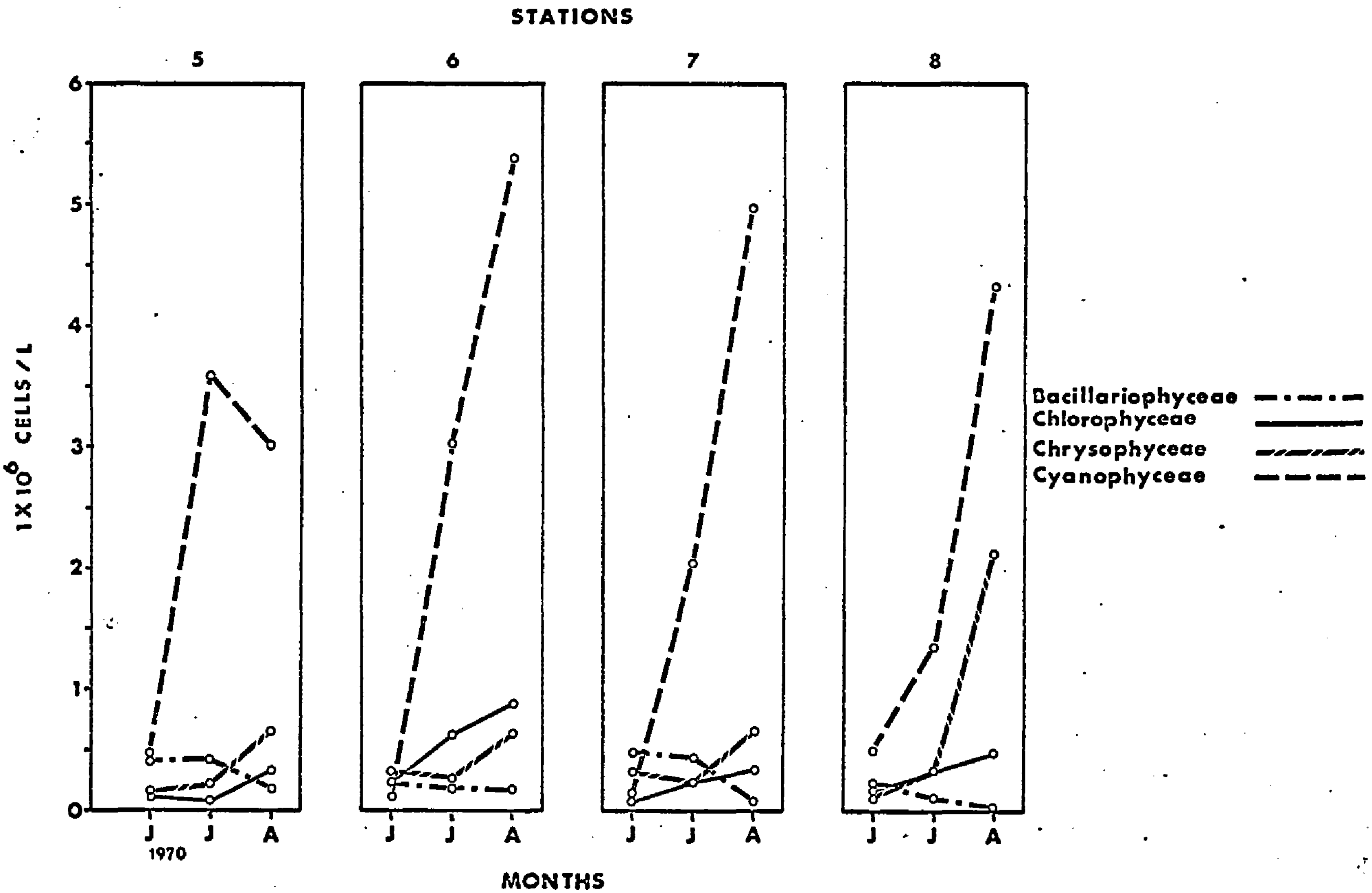

STATIONS
5
6
7
8
1 X 10^6 CELLS / L
0
1
2
3
4
5
6
J
J
A
1970
MONTHS
Bacillariophyceae
Chlorophyceae
Chrysophyceae
Cyanophyceae

FIGURE 13

SEASONAL VARIATION IN NUMBERS OF CELLS

AT STATIONS 5 - 8

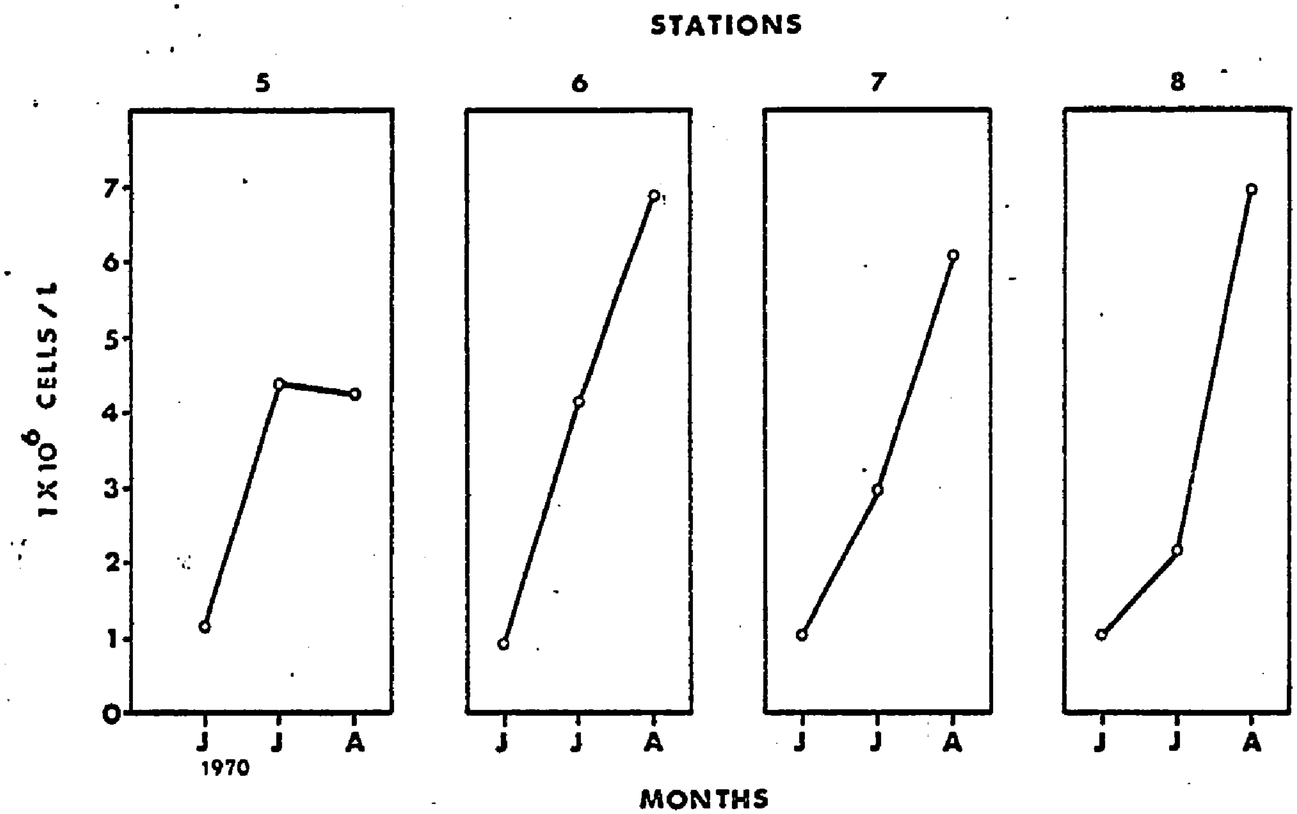
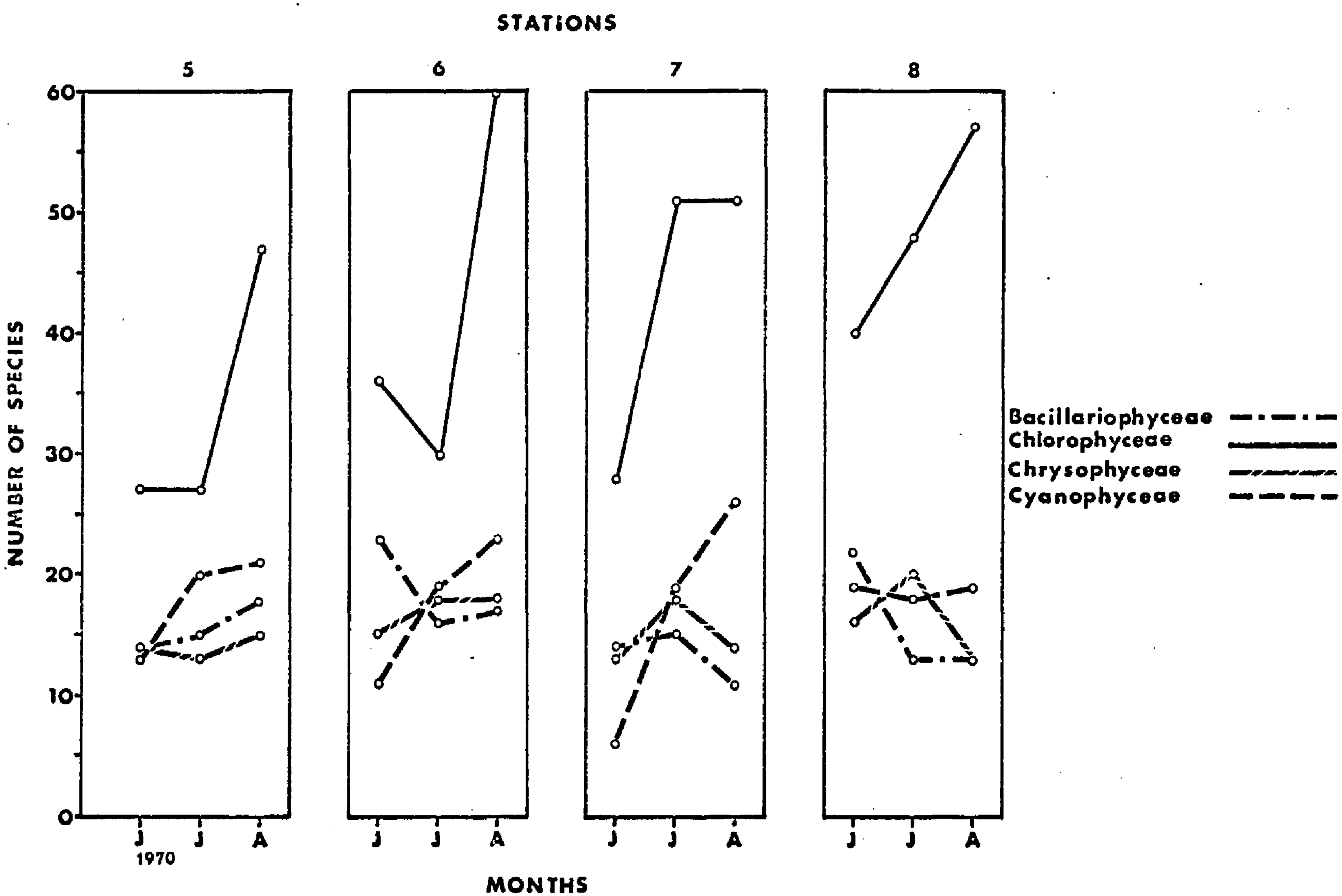

STATIONS
5
6
7
8
1 X 10^6 CELLS / L
0
1
2
3
4
5
6
7
J
J
A
1970
MONTHS

FIGURE 14

SEASONAL VARIATION IN NUMBERS OF SPECIES

PER CLASS AT STATIONS 5 - 8


STATIONS
5
6
7
8
NUMBER OF SPECIES
60
50
40
30
20
10
0
J
J
A
1970
MONTHS
Bacillariophyceae
Chlorophyceae
Chrysophyceae
Cyanophyceae